Euphausiids, Coelenterates, Ctenophores, and other Zooplankton from the Canadian Pacific Coast Ichthyoplankton Survey, 1980

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ABSTRACT

Fulton, J., M. N. Arai, and J. C. Mason. 1982. Euphausiids, coelentrates, ctenophores, and other zooplankton from the Canadian Pacific coast ichthyoplankton survey, 1980. Can. Tech. Rep. Fish. Aquat. Sci. No. 1125: v + 75 p.

The major zooplankton components of 297 Bongo net samples from four monthly cruises made between January and April 1980 in the B.C. shelf waters, Hecate Strait, and Queen Charlotte Sound were examined. The distribution and abundance of euphausiids, coelentrates, ctenophores, and other net zooplankton were examined. Growth rates for the three dominant euphausiid species were determined from length-frequency analysis at three selected stations. Preliminary estimates of euphausiid standing stock, net production and mortality were derived and localities where exploratory commercial fishing of euphausiids could be potentially profitable are shown. Spatial temporal aspects of recruitment for the dominant copepod and possible interactions between zooplankton and ichthyoplankton are discussed.

Key words: Zooplankton, euphausiids, coelentrates, ctenophores, standing stock, production, mortality, Canadian Pacific shelf, Dixon Entrance, Hecate Strait, Queen Charlotte Sound.

RÉSUMÉ

Fulton, J., M. N. Arai, and J. C. Mason. 1982. Euphausiids, coelentrates, ctenophores, and other zooplankton from the Canadian Pacific coast ichthyoplankton survey, 1980. Can. Tech. Rep. Fish. Aquat. Sci. No. 1125: v + 75 p.

Le présent rapport traite des principales espèces de zooplancton contenues dans 297 échantillons recueillis à l'aide de filets Bongo au cours de quatre croisières mensuelles menées de janvier à avril 1980 dans les eaux du plateau continental de la C.-B., du détroit d'Hécate et du bassin Reine-Charlotte. On étudie la répartition et l'abondance des euphasiacés, des coelentérés, des cténaires et d'autres espèces de zooplancton capturées. Les taux de croissance des trois principales espèces d'euphausiacés sont déterminés à partir de l'analyse de la fréquence des longueurs à trois sites choisis. L'ouvrage donne des évaluations préliminaires du stock actuel, de la production nette et de la mortalité des euphausiacés. On indique aussi les endroits où la pêche commerciale exploratoire de cette espèce pourrait être rentable. Le rapport traite des aspects spatio-temporels du recrutement pour les principaux copépodes, ainsi que des interactions possibles entre le zooplancton et l'ichtyoplancton.

Mots-clés: zooplancton, euphausiacés, coelentérés, cténaires, stock actuel, production, mortalité, plateau continental du Pacifique, entrée Dixon, détroit d'Hécate, bassin Reine-Charlotte.

ORIENTATION AND METHODOLOGY

The Pacific Coast Ichthyoplankton Survey was conducted by staff of the Groundfish Program at the Pacific Biological Station, Nanaimo (Resource Services Branch). The survey involved four monthly cruises of some 9 days duration, each made on the G. B. REED (January 15-22, February 13-20, March 12-20, and April 15-23).

The survey encompassed the entire length of the Canadian outer coast and also included Dixon Entrance, Hecate Strait, and Queen Charlotte Sound. A total of 77 stations on 18 transect lines were occupied routinely (Fig. 1). The stations are listed by number, location (latitude and longitude), and depth in Table 1.

On station, following oblique tows for ichthyoplankton, an STD cast (Bisset Berman) was made, supplemented irregularly by XBT casts, and by Nansen casts, with salinometry done ashore. The physical-chemical data base is presented in processed form in three parts (Data Report No. 279, 280, and 281).

The oblique tows were made using 0.25 m^2 Bongos equipped with 351 µm Nitex nets of modified SCOR design, and General Oceanics center-mounted flow-meters. A 100-kg minesweeper depressor was used on the January cruise but was replaced with a 75-kg cylindrical weight for the subsequent cruises in order to minimize stress on the gear and cable induced by the depressor while in the surface surge zone. All sampling gear was colored black to minimize potential avoidance and resulting catch bias.

The tow procedure generally followed that established by CALCOFI: vessel speed 2 kts, gear descent at a cable pay-out rate of 50 m/min, and gear ascent at a cable recovery rate of 20 m/min. Tows were made to within 20 m of the sea floor on shelf stations, and to a maximum depth of 565 m on slope stations where bottom depths exceeded 900 m at the most seaward stations.

The recovered nets were thoroughly washed down with a high-pressure deck hose and the resulting catches were preserved in 5% buffered seawater formaldehyde for processing ashore. In the laboratory, fish, fish eggs and larvae, euphausiids, decapods, medusae and ctenophores were extracted from left-net catches. Detailed examination of the selected faunal groups was undertaken. Euphausiids from all stations were drained and spread on blotting paper to remove interstitial water and weighed (wet weight biomass); from all stations deeper than 180 m all euphausiids were identified to species; from selected stations body length (base of eye to junction of abdomen and telson) measurement were made. Medusae and ctenophores were counted for all stations and identified to species except in a few cases when they were badly damaged in capture. All decapods were removed and stored for future study. Fish, fish eggs and larvae are the subject of other reports (Mason et al. 1981). Dominant species were identified from the remainder of the sample and drained wet weight measurement were made to the nearest 0.01 g. The entire catches from the other net were retained in a raw reference collection for future use.

TABLE 1. Tracklines and their associated stations, station locations, and station depths for the West Coast Ichthyoplankton Survey, January through April, 1980.

Trackline no.	Station no.	Latitude	Longitude to nearest min.	Station depth (m)
1	1	48° 30'	124° 23'	91
	2		124° 33'	182
	3		124° 52'	182
	4		125° 18'	182
	5		125° 43'	100
	6		126° 05'	182
	7		126° 24'	910
2	8	49° 00'	126° 56'	910
	9		126° 33'	182
	10		126° 14'	100
	11		126° 04'	55
3	12	49° 30'	126° 44'	55
	13		126° 54'	100
	14		127° 14'	182
	15		127° 34'	910
4	16	50° 00'	127° 59'	910
	17		127° 52'	100
	18		127° 43'	182
	19		127° 35'	55
5	20	50° 30'	128° 14'	55
	21		128° 19'	100
	22		128° 26'	182
	23		128° 40'	910
6	24	51° 00'	129° 48'	910
	25		129° 21'	182
	26		128° 56'	76
	27		128° 31'	100
	28		128° 06'	100
7	29	51° 30'	128° 31'	164
	30		128° 56'	100
	31		129° 21'	100
	32		129° 51'	182
	33		130° 24'	910

TABLE 1 (contd).

Trackline no.	Station no.	Latitude	Longitude to nearest min.	Station depth (m)
8	34	52° 00'	131° 09'	100
	35		131° 12'	182
	36		131° 23'	910
9	37	52° 30'	131° 56'	910
	38		131° 47'	182
10	39	53° 00'	132° 26'	182
	40		132° 40'	910
	41		132° 53'	910
11	42	53° 20'	133° 19'	910
	43b		133° 09'	637
	43a		133° 05'	218
	43		133° 01'	182
	44		132° 57'	100
12	45	54° 00'	133° 13'	55
	46		133° 27'	64
	47		133° 31'	182
	48		133° 48'	910
13	49	54° 30'	134° 06'	910
	50		133° 49'	182
	51		133° 22'	364
	52		132° 55'	365
	53		132° 27'	364
	54		132° 00'	246
	55		131° 34'	282
	56		131° 07'	146
14	57	54° 00'	131° 25'	18
	58		131° 08'	55
	59		130° 50'	100
15	60	53° 30'	130° 42'	100
	61		131° 05'	55
	62		131° 02'	22
16	63	53° 00'	131° 06'	55
	64		130° 40'	100
	65		130° 13'	228
	66		129° 47'	55
17	67	52° 30'	129° 48'	182
	68		130° 13'	273
	69		130° 40'	100
	70		131° 07'	55

TABLE 1 (contd).

Trackline no.	Station no.	Latitude	Longitude to nearest min.	Station depth (m)
18	71	52° 00'	130° 41'	228
	72		130° 14'	100
	73		129° 48'	100
	74		129° 21'	182
	75		128° 56'	100

Table 2. Euphausiid and zooplankton biomass for West Coast Cruises, 1980.

Notes:

- D/N - Time is indicated as night after sunset and before sunrise as listed in the nautical almanac for the approriate latitude.
- TSW - samples were too small to weigh, i.e., less than 0.10 g.
- PHYTO - Samples which were not weighed because large quantities of phytoplankton were present.
- CONTAM - sample was contaminated with mud or sand from contacting bottom.

Station	Time	Date	Depth (m)	Euphausiids (g/10 m2)	Zooplankton (g/10 m2)
01	N	09/01	79	1.49	TSW
02	N	09/01	183	3.81	TSW
03	N	10/01	156	35.73	TSW
04	N	15/01	165	15.07	TSW
06	N	10/01	139	7.36	TSW
07	D	15/01	518	12.16	89.16
08	D	15/01	476	0.89	97.33
09	D	15/01	130	0.00	TSW
10	N	15/01	59	TSW	TSW
11	N	15/01	45	TSW	TSW
12	N	16/01	27	TSW	TSW
13	N	16/01	64	TSW	TSW
14	N	16/01	152	0.70	TSW
15	N	16/01	418	20.49	56.72
16	D	16/01	335	1.52	36.27
17	D	16/01	70	TSW	TSW
18	D	16/01	72	TSW	TSW
19	D	16/01	47	TSW	TSW
20	D	16/01	34	TSW	TSW
21	N	16/01	98	18.65	32.13
22	N	16/01	152	29.55	3.28
23	N	16/01	316	34.42	46.77
24	D	17/01	375	96.49	81.49
25	D	17/01	150	0.12	TSW
26	N	17/01	53	0.00	TSW
27	N	17/01	58	0.00	TSW
28	N	17/01	63	0.09	TSW
29	N	22/01	170	54.32	13.58
30	N	22/01	38	0.03	TSW
31	N	22/01	54	0.01	TSW
32	D	22/01	144	3.60	TSW
33	N	17/01	477	1.88	TSW
34	N	17/01	119	243.26	12.80
35	N	17/01	168	226.72	TSW

Table 2 (cont'd)

Station	Time	Date	Depth (m)	Euphausiids (g/10 m^2)	Zooplankton (g/10 m^2)
36	N	18/01	460	19.64	51.82
37	N	18/01	443	31.49	75.62
38	N	18/01	154	82.70	9.22
39	D	18/01	117	0.24	TSW
40	D	18/01	173	14.16	3.54
43	N	18/01	168	45.02	5.35
43A	N	18/01	113	3.20	TSW
44	D	18/01	123	TSW	TSW
45	N	18/01	52	TSW	TSW
46	N	19/01	75	TSW	TSW
52	D	19/01	307	6.63	83.40
53	D	19/01	350	3.25	94.01
54	D	19/01	183	10.32	36.31
55	D	20/01	234	31.21	277.22
56	D	20/01	96	TSW	TSW
57	D	20/01	21	TSW	TSW
58	D	20/01	29	0.01	TSW
59	D	20/01	69	TSW	TSW
60	N	20/01	129	0.42	TSW
61	N	20/01	34	0.09	TSW
62	N	20/01	18	0.04	TSW
63	N	21/01	34	0.04	TSW
64	N	21/01	116	0.20	TSW
65	D	21/01	169	10.82	TSW
66	D	21/01	190	8.83	60.74
67	D	21/01	151	2.56	TSW
68	N	21/01	219	7.02	40.24
69	N	21/01	78	TSW	TSW
70	N	21/01	119	1.80	TSW
71	N	22/01	194	26.26	TSW
72	N	22/01	202	159.10	17.68
73	D	22/01	78	0.82	TSW
74	D	22/01	155	2.89	TSW
75	D	22/01	84	TSW	TSW

Table 2 (cont'd) Cruise WC2

Station	Time	Date	Depth (m)	Euphausiids (g/10 m^2)	Zooplankton (g/10 m^2)
01	N	13/02	53	4.12	PHYTO
02	N	13/02	160	22.87	PHYTO
03	D	13/02	136	5.59	TSW
04	D	13/02	109	0.00	PHYTO
05	D	13/02	46	0.23	TSW
06	D	13/02	155	0.00	TSW
07	D	13/02	537	4.52	TSW
08	N	13/02	524	92.12	128.55
09	N	13/02	119	8.59	TSW
10	N	14/02	74	21.39	TSW
11	N	14/02	37	1.24	TSW
12	N	14/02	20	0.06	TSW
13	N	14/02	65	0.06	TSW
14	D	14/02	137	0.00	TSW
15	D	14/02	483	24.65	TSW
16	D	14/02	528	10.35	203.76
17	D	14/02	147	0.24	TSW
18	D	14/02	54	0.00	TSW
19	D	14/02	34	0.03	TSW
20	N	14/02	22	0.14	TSW
21	N	14/02	49	0.00	TSW
22	N	14/02	131	229.11	TSW
23	N	15/02	523	42.68	120.53
24	D	15/02	583	25.53	122.03
25	D	15/02	139	0.00	TSW
26	N	15/02	48	0.00	TSW
27	N	15/02	58	0.00	TSW
28	D	20/02	120	0.00	TSW
29	N	20/02	192	82.48	63.36
30	N	20/02	46	0.08	TSW
31	N	20/02	55	0.00	TSW
32	D	15/02	148	5.44	TSW
33	D	15/02	445	50.51	85.62
34	N	15/02	90	7.81	TSW
35	N	15/02	135	121.41	TSW
36	N	16/02	508	103.44	78.39
37	N	16/02	476	59.70	TSW
38	N	16/02	182	71.74	20.64
39	D	16/02	63	0.00	TSW
40	D	16/02	155	0.10	TSW
41	D	16/02	439	12.10	236.63
42	N	16/02	548	44.61	162.87
43	D	16/02	152	0.15	TSW
43A	N	16/02	174	4.02	TSW
43B	N	16/02	350	47.35	TSW
44	D	16/02	96	0.03	TSW
45	N	17/02	31	0.00	TSW
46	N	17/02	64	0.94	TSW

Table 2 (cont'd)

Station	Time	Date	Depth (m)	Euphausiids (g/10 m^2)	Zooplankton (g/10 m^2)
47	N	17/02	177	115.59	TSW
48	N	17/02	494	30.87	170.29
49	D	17/02	430	4.07	118.32
50	D	17/02	261	3.81	55.94
51	D	17/02	247	18.05	27.09
52	D	17/02	278	3.56	51.88
53	N	17/02	304	80.74	65.84
54	N	17/02	152	25.83	27.88
55	N	17/02	234	108.54	TSW
56	N	18/02	147	49.06	35.23
57	N	18/02	13	0.00	TSW
58	N	18/02	18	0.00	TSW
59	D	18/02	51	0.00	TSW
60	D	18/02	101	0.00	TSW
61	D	18/02	26	0.00	TSW
62	D	18/02	18	0.00	TSW
63	N	18/02	16	0.00	TSW
64	N	18/02	106	0.00	TSW
65	N	18/02	170	572.35	TSW
66	N	19/02	168	30.44	TSW
67	N	19/02	176	31.61	TSW
68	N	19/02	238	3.75	TSW
69	D	19/02	62	0.00	TSW
70	D	19/02	97	0.00	TSW
71	D	19/02	97	1.60	TSW
72	D	19/02	190	12.83	TSW
73	N	19/02	208	0.76	TSW
74	N	19/02	100	235.44	TSW
75	N	19/02	119	4.93	TSW

Table 2 (cont'd) Cruise WC3

Station	Time	Date	Depth (m)	Euphausiids (g/10 m^2)	Zooplankton (g/10 m^2)
01	N	12/03	82	10.15	PHYTO
02	N	12/03	199	0.96	90.02
03	N	12/03	139	61.39	107.29
04	D	12/03	146	7.58	56.83
05	D	12/03	95	0.00	32.69
06	D	12/03	183	68.30	152.04
07	D	12/03	1097	2.40	95.21
08	N	12/03	548	9.97	127.59
09	N	12/03	155	91.61	72.38
10	N	12/03	91	57.35	109.67
11	N	13/03	55	0.00	39.78
12	N	13/03	46	0.02	103.90
13	D	13/03	100	0.31	149.86
14	D	13/03	173	62.58	113.19
15	D	13/03	1280	2.48	118.40
16	D	13/03	732	3.99	512.45
17	D	13/03	274	58.43	808.09
18	D	13/03	86	0.00	106.30
19	D	13/03	62	0.00	100.30
20	N	13/03	40	0.00	51.68
21	N	13/03	124	0.00	38.66
22	N	13/03	183	36.07	99.59
23	N	14/03	1061	218.32	233.22
24	D	14/03	914	9.38	152.16
25	D	14/03	173	14.55	60.31
26	N	14/03	77	0.03	73.20
27	N	14/03	86	0.21	73.10
28	N	19/03	91	3.43	115.42
29	D	19/03	194	21.36	96.23
30	D	19/03	53	0.05	33.51
31	D	19/03	55	0.00	37.28
32	D	14/03	183	14.84	57.06
33	D	14/03	914	28.03	101.64
34	N	14/03	91	400.63	2.84
35	N	14/03	275	119.97	44.93
36	N	14/03	1280	214.61	140.74
37	N	15/03	914	251.69	143.93
38	N	15/03	199	28.68	27.83
39	D	15/03	128	0.04	16.44
40	D	15/03	457	18.76	59.97
41	D	15/03	878	3.07	117.26
42	N	15/03	878	80.27	82.35
43	D	15/03	265	24.10	28.68
43A	D	15/03	256	4.55	28.70
43B	N	15/03	594	9.15	99.00
44	D	15/03	139	0.12	10.85
45	N	16/03	55	0.00	9.08
46	D	16/03	91	0.00	7.51

Table 2 (cont'd)

Station	Time	Date	Depth (m)	Euphausiids (g/10 m^2)	Zooplankton (g/10 m^2)
47	D	16/03	204	6.26	28.59
48	D	16/03	1140	16.32	130.54
49	N	16/03	1204	22.44	134.03
50	N	16/03	256	63.54	23.98
51	N	16/03	256	74.25	23.16
52	N	17/03	384	17.05	47.34
53	N	17/03	375	33.59	496.70
54	D	17/03	256	14.95	196.77
55	D	17/03	275	9.11	150.67
56	D	17/03	143	4.41	162.94
57	D	17/03	24	0.00	PHYTO
58	D	17/03	36	0.00	12.37
59	D	17/03	64	0.03	3.94
60	N	17/03	110	6.41	23.41
61	N	17/03	37	0.03	7.33
62	N	18/03	24	0.00	PHYTO
63	N	18/03	31	0.00	43.26
64	D	18/03	92	1.18	10.13
65	D	18/03	220	24.53	53.14
66	D	18/03	256	0.00	56.64
67	D	18/03	200	3.76	31.06
68	D	18/03	310	1.00	CONTAM.
69	N	18/03	99	0.10	11.62
70	N	18/03	137	0.18	16.41
71	N	18/03	245	362.77	39.92
72	N	19/03	284	332.96	57.39
73	N	19/03	117	114.20	77.82
74	N	19/03	201	21.71	73.32
75	D	19/03	117	0.07	49.86

Table 2 (cont'd) Cruise WC 4

Station	Time	Date	Depth (m)	Euphausiids (g/10 m^2)	Zooplankton (g/10 m^2)
01	N	15/04	91	33.69	PHYTO
02	N	15/04	200	15.17	PHYTO
03	N	16/04	183	800.28	341.64
04	N	16/04	141	235.57	195.12
05	D	16/04	91	0.17	91.92
06	D	16/04	183	0.75	75.41
07	D	16/04	1170	2.04	202.84
08	D	16/04	768	48.28	259.12
09	D	16/04	161	0.36	114.11
10	D	16/04	95	1.53	85.81
11	D	16/04	55	7.04	PHYTO
12	N	17/04	49	0.00	51.65
13	N	17/04	101	18.48	143.88
14	N	17/04	192	45.86	PHYTO
15	N	17/04	1002	15.10	188.11
16	D	17/04	914	4.09	358.85
17	D	17/04	182	1.94	351.39
18	D	17/04	67	0.00	PHYTO
19	D	17/04	64	0.00	170.15
20	D	17/04	42	0.02	136.64
21	D	17/04	117	0.00	94.33
22	D	17/04	183	20.48	242.75
23	D	17/04	1006	23.83	328.89
24	N	18/04	1079	43.57	112.86
25	N	18/04	187	35.76	90.60
26	N	17/04	91	0.00	34.32
27	N	17/04	91	0.00	43.91
28	D	23/04	101	0.00	55.44
29	D	23/04	183	23.15	280.35
30	N	23/04	42	0.00	PHYTO
31	N	23/04	55	0.02	PHYTO
32	N	23/04	183	122.59	217.60
33	N	22/04	914	10.32	287.37
34	N	18/04	101	0.13	PHYTO
35	N	18/04	183	91.43	60.44
36	N	18/04	914	228.53	148.65
37	N	19/04	914	245.14	186.92
38	N	19/04	202	216.07	50.60
39	D	19/04	91	2.07	PHYTO
40	D	19/04	183	67.98	15.59
41	D	19/04	914	123.19	175.74
42	D	19/04	1207	22.39	420.28
43	D	19/04	256	239.14	49.49
43A	D	19/04	210	2.05	27.03
43B	D	19/04	677	9.68	153.89
44	D	19/04	135	0.95	PHYTO
45	N	19/04	55	0.00	PHYTO
46	N	19/04	91	4.87	45.02

Table 2 (cont'd)

Station	Time	Date	Depth (m)	Euphausiids (g/10 m^2)	Zooplankton (g/10 m^2)
47	N	19/04	183	53.90	38.04
48	N	20/04	896	401.96	303.03
49	N	20/04	1463	5.25	465.85
50	D	20/04	220	4.51	204.96
51	D	20/04	274	7.62	90.08
52	D	20/04	380	56.73	136.73
53	D	20/04	373	12.75	216.75
54	D	20/04	285	14.24	214.79
55	D	20/04	284	29.44	122.61
56	N	20/04	137	5.87	PHYTO
57	N	20/04	18	0.00	PHYTO
58	N	21/04	37	0.00	PHYTO
59	N	21/04	70	0.10	33.13
60	N	21/04	139	2.08	42.96
61	D	21/04	37	0.00	PHYTO
62	D	21/04	22	0.00	9.78
63	D	21/04	24	5.35	PHYTO
64	D	21/04	55	0.00	PHYTO
65	D	21/04	187	4.80	40.99
66	D	21/04	220	4.07	101.34
67	N	21/04	183	417.05	57.73
68	N	21/04	311	137.23	TSW
69	N	22/04	102	0.00	24.48
70	N	22/04	146	0.00	69.43
71	D	22/04	229	19.73	PHYTO
72	D	22/04	283	19.85	157.34
73	D	22/04	110	0.00	PHYTO
74	D	22/04	192	12.70	43.90
75	D	22/04	113	0.05	34.51

PART I, EUPHAUSIIDS

Sampling Problems

West coast sampling in 1980 was designed specifically to catch fish eggs and larvae. The incidental catch of euphausiids extends our knowledge of the distribution of this group on the shelf. The daytime observations should be interpreted with caution however and the growth and production estimates should be considered incomplete. Euphausiids generally live during the day at depths greater than 150 m usually in layers (scattering layers) which may be continuous or discontinuous (patchy) and may vary in thickness. Commercial species of euphausiids usually migrate toward the surface as light values begin to decrease at sunset. On bright moonlight nights euphausiids may not migrate all the way to the surface or form as dense layers as they do on dark nights. Sometimes Euphausia pacifica has been found in swarms on the surface during daylight in the Strait of Georgia. There have been reports of "plankton swarms" off the west coast but casual observers have never confirmed the identity of the organisms involved. The concentration of swarming euphausiids may be as high as 40,000/m^3 according to Terazaki (1980).

Since euphausiid distributions are extremely patchy it is not surprising that traditional net sampling does not yield suitable biomass estimates. High frequency echo sounders (120 kHz) can be used to map the horizontal and vertical distributions of euphausiids. Aggregations of targets can be sampled by positioning an opening-closing horizontally towed plankton trawl with reference to the high frequency echo sounder trace. Echo integration techniques augmented with occasional net hauls can provide biomass estimates of high reliability according to Pieper (1979).

According to Brinton and Townsend (1981) the bongo net sampling technique produce biomass estimates of Euphausia pacifica during darkness about 2-20 times greater than in daylight.

Calibration trials with Bongo nets in the Strait of Georgia in October 1981 showed that night sampling yielded population estimates 3 to 20 times larger for E. pacifica and 4 to 6 times larger for T. longipes than did day sampling (Fulton and Mason, unpublished data). At selected stations from west coast cruises (Table 4) the mean biomass for day samples was 18.8 g/10 m^2 and for night samples was 196.5 g/10 m^2 giving a night to day ratio of 10.4. Accordingly, correction factor multipliers of 10 for E. pacifica and 5 for T. longipes have been applied to daytime biomass estimates at these stations. West coast seasonal biomass estimates were made only from night samples.

SPECIES

Twelve species of euphausiids were identified from the west coast samples (Table 3), seven of which were reported from the Strait of Georgia (Fulton 1968) and eleven which were reported previously from the west coast of British Columbia (Brinton 1962; Mauchline 1980). Four bathypelagic species

known from northeastern Pacific (Brinton 1962) were not found. Thysanoessa inspinata was identified for the first time from British Columbia coastal waters but since it is easily confused with T. longipes (spineless form) and T. gregaria it most likely has been included with T. longipes in the past. Banner (1949) considered all records of T. gregaria north of 45°N as belonging to T. longipes and Nemoto (1963) notes that the illustration reported as T. longipes (Boden et al. 1955) is T. inspinata.

Table 3. Species of euphausiid identified from the west coast of Canada.

A) Dominant species usually accounting for 90% of euphausiid biomass.

Thysanoessa spinifera
Thysanoessa longipes
Euphausia pacifica

B) Common species occurring in more than 10% of samples containing euphausiids.

Thysanoessa inspinata
Thysanoessa longipes (spineless form)
Thysanoessa inermis
Thysanoessa raschii
Tessarabrachion oculatum
Nematoscelis difficilis

C) Rare species usually in samples from more than 200 m depth.

Thysanopoda acutifrons
Nematobrachion flexipes
Stylocheiron longicorne
Stylocheiron maximum

D) Species reported in samples from deeper than 500 m in the area sampled but not found.

Bentheuphausia amblyops
Thysanopoda cornuta
Thysanopoda egregia
Thysanopoda cristata

The dominant species (see Table 4) at Station 36 for all four cruises was Thysanoessa spinifera with Euphausia pacifica second in abundance. Tessarabranchion oculatum was the only other euphausiid to make up more than 10% of the biomass but was important only on the first cruise. At Station 55 Thysanoessa longipes was dominant during cruise 1 and 3; T. spinifera was dominant for cruise 2 and E. pacifica was dominant for cruise 4. At Station 3 E. pacifica was dominant for all cruises with T. spinifera second in abundance except during the second cruise when Nematoscelis difficilis made up 8% of the estimated euphausiid biomass. It is

noticeable that T. spinifera, the largest of the abundant euphausiids, was abundant only at night indicating that it either avoids Bongo nets during daytime or migrates to depths not sampled.

Table 4. Euphausiid species composition by percent biomass at four stations, day samples are corrected - see text.

	%E. pac.	%T. spin.	%T. long.	%Other	Uncorrected Wet weight g/10 m^2	Corrected Wet weight g/10 m^2
Station 3						
Cruise						
1N[a]	68	31	0	tr	35.7	-
2	93	0	0	8[b]	5.6	34.2
3N	56	44	0	0	61.4	-
4N	93	7	0	0	800.3	-
Station 36						
Cruise						
1N	19	67	0	14[c]	19.6	-
2N	38	62	0	tr	103.4	-
3N	49	51	tr	tr	214.6	-
4N	18	77	1	tr	228.5	-
Station 55						
Cruise						
1	19	0	81	tr	31.2	167.8
2N	28	52	17	3	108.5	-
3	16	0	83	tr	9.1	38.8
4	77	tr	22	0	29.4	224.4

[a]N = samples taken during darkness.
[b]Nematoscelis difficilis.
[c]Tessarabrachion oculatum.

HORIZONTAL DISTRIBUTION AND ABUNDANCE

During the day euphausiid stocks were most abundant in water deeper than 200 m; at night they could be found in shallower water adjacent to deep water (Table 5). The four submarine canyons, Juan de Fuca canyon, Mitchell's Gully, Moresby Gully, and Dixon Entrance, cutting through the continental shelf, all contained concentrations of euphausiids (Fig. 2-5). Mauchline (1980) lists the average day depth of the dominant euphausiids:

Euphausia pacifica	400-150 m
Thysanoessa spinifera	100- 0 m
T. longipes	250- 50 m

and notes that light is probably the dominant factor controlling vertical migration. Roger (1974) found that the depth of distribution of euphausiids in the upper 200 m at night was directly proportional to the intensity of the moonlight. In 1980 samples were taken as early as 9 days (January) before new new moon to as late as 9 days (in April) after the new moon so that vertical migration should not have been inhibited by bright moonlight. No light meter readings were taken.

Table 5. Euphausiid biomass distribution with depth during night and day.

Cruise	Time	Depth relative to 200 m isobath	Mean wet wt. biomass of euphausiids g/10m^2	Number of stations
WC-1	Night	Deep	39.2	7
		Shallow	24.2	33
	Day	Deep	21.7	7
		Shallow	2.6	21
WC-2	Night	Deep	55.8	11
		Shallow	49.7	33
	Day	Deep	15.7	10
		Shallow	1.1	23
WC-3	Night	Deep	122.2	15
		Shallow	35.3	23
	Day	Deep	12.8	18
		Shallow	9.3	21
WC-4	Night	Deep	131.8	10
		Shallow	74.7	25
	Day	Deep	35.8	18
		Shallow	6.2	24

Length frequency measurements

Euphausiids from selected stations were sorted into species and total length (measured from the base of the eye to the junction of the abdomen and telson) was measured. Growth rates were calculated for the three dominate species (Table 6) ignoring such factors as size selective mortality and

day/night differences in the catch power of the net, assuming that the populations sampled remained in the same geographical location during the four month sampling period. Table 4 shows that day samples contained only traces of T. spinifera. The low growth rate calculated for E. pacifica at station 55 in Table 6 may be due to size selection during day sampling. Brinton and Townsend (1981) found similar problems with day/night comparisons of euphausiid catches off the California coast.

Length measurements were transformed to weight estimates using the conversion factor arrived at for E. pacifica from the Strait of Georgia by Heath (1977).

$$\ln W = -4.7 + 2.92 \ (\ln L) \qquad (1)$$

where W = wet weight in mg and L = length in mm.

Mean growth (% wt. change/day) estimates were also calculated:

$$\Delta W = 100\% \ [10^{1/t}(\log W_2 - \log W_1) - 1] \qquad (2)$$

where W_1 is the wet weight (mg) at the time of first observation and W_2 is the weight (mg) at the time of second observation, and t is the interval (days) between observations.

Mean growth (xmm/day) estimates were calculated from the following equation:

$$\Delta L = \frac{L_2 - L_1}{t} \qquad (3)$$

where L_1 is length (mm) at first observation, L_2 is length (mm) at last observation, and t is the interval (days) between observation, using modal analysis.

Mean daily growth estimates based on changes in length for E. pacifica (0.043 - 0.079 mm) were close to the range (0.063 - 0.083 mm) established by Smiles and Pearcey (1971) during a five year study of populations off the coast of Oregon.

Table 6. Mean daily growth rate (January-April) of dominant euphausiid species from three selected stations.

Station	E. pacifica		T. longipes		T. spinifera	
	Length (mm)	Weight %	Length (mm)	Weight %	Length (mm)	Weight %
3[a]	0.068	1.64	-	-	-	-
36[b]	0.079	1.99	-	-	0.059	1.36
55[c]	0.043	0.87	0.025	0.62	-	-
All stations combined	0.064	1.49				

[a]Mostly night samples.
[b]All night samples.
[c]Mostly day samples.

Length-frequency plots for all species (Fig. 6 to Fig. 9) show little or no growth during the January to February interval and in all cases best growth in the March and April interval. T. spinifera growth was mainly limited to the last 34 day period (Fig. 8). T. longipes exhibited negative growth during January but since only the February sample was taken at night, the results are inconclusive (Fig. 9). E. pacifica at all three stations appeared to grow in the first month but grew best in the last month. Other euphausiid populations as reviewed by Smiles and Pearcey (1971) show greatly reduced growth during winter.

The mean biomass for each monthly cruise was calculated using only data from stations deeper than 200 m sampled at night. The range of 3.9 to 13.2 g/m^2 (Table 7) is comparable to the estimate of 12 g/m^2 made by Chuckukalo (1973) although he used a larger net. The estimated mean daily growth rate for E. pacifica for the entire January - April sampling period (Table 6) was used to calculate euphausiid production for the west coast. Estimated daily production increased from 4.7 mg C/m^2 in January to 15.7 mg C/m^2 in April. Although this is lower than the annual range calculated for E. pacifica in Georgia Strait (6-27 mg C/m^2) by Heath (1977), comparisons could be misleading because the sampling programs differed significantly.

Seasonal increase in euphausiid biomass and net production were calculated (Table 7) and plotted (Fig. 10). Net production between sampling intervals was calculated using the equation

$$W_t = W_o \left[(1+{}_{\Delta}W)^{t+1}-(1+{}_{\Delta}W)\right] + W_o \qquad (4)$$

Where W_o is the mean biomass at the beginning of the time interval, ${}_{\Delta}W$ is the mean daily growth rate calculated for the interval, t is the number of days in the interval, and W_t is the estimated biomass at the end of the interval.

The difference between the net production curve and the biomass curve in Fig. 10 is an estimate of mortality. During the January-March interval, mortality amounted to some 6% of net production and increased to about 35% in this March-April period. This six-fold increase in total mortality is likely due to increased fish predation.

Table 7. Biomass, growth, and production estimates of euphausiids January to April 1980.

Time	Mean monthly* biomass (g/m^2)	Mean daily* growth (%)	Mean daily production	
			Wet wt. (mg/m^2)	Carbon* (mg/m^2)
Jan.	3.9	1.49	58.4	4.7
Feb.	5.6	-	83.1	6.7
March	12.2	-	182.1	14.6
April	13.2	-	196.4	15.7
4 month mean	8.7	-	130.1	10.4

*Biomass from mean of all night stations in water deeper than 200 m.
*Growth estimate is 4 month mean for E. pacifica.
*Carbon is assumed to be 8% of wet weight (see Matthews and Hienidahl, 1980).

COMMERCIAL EUPHAUSIID FISHERY

A commercial surface trawl 11 ft x 24 ft (24 m^2) towed at 2 knots (1 m/sec) filters about 1440 m^3/min. According to fishermen (pers. comm.) catches must exceed 1 lb/min (453 g/min) to be acceptable for profitable fishing. From this information critical concentrations of euphausiids can be calculated:

$$\frac{450 \text{ g/min}}{1440 \text{ m}^3/\text{min}} = 0.31 \text{ g/m}^3$$

The west coast survey samples were taken both night and day with nets hauled obliquely through the entire water column. Biomass estimates are expressed as the weight of euphausiids under 10 m^2 of surface area. High frequency (100-200 kHz) echosounding data indicates that euphausiids usually migrate vertically at dusk and form layers 5-20 m thick at night in surface

waters (Sameoto 1976; Bary and Pieper 1970; Pieper 1979). If all the euphausiids in the water column were concentrated at night in a layer 10 m thick then all stations in the survey where the biomass is estimated at greater than 31 g/10 m^2 are potential commercial fishing areas. The largest catch was made at night at Station 3 in April. Commercial gear could, in theory, catch 115.2 kg/min (254 lb/min) when euphausiids are concentrated to this extent. In the first cruise ten stations, and in the last three cruises more than 19 stations had euphausiid concentrations which exceeded the hypothetical lower limit of 31 g/10 m^2 necessary for profitable fishing (Table 8).

Table 8. Number of west coast stations where euphausiids reach commercial concentrations.

Cruise	Number of stations where biomass of euphasiids exceeded		
	31 g/10 m^2	100 g/10 m^2	300 g/10 m^2
WC-1	10	4	1
WC-2	19	7	1
WC-3	19	8	3
WC-4	20	11	3

PART II. COELENTERATES AND CTENOPHORES

From a zoogeographical viewpoint, this collection of coelenterates is of particular interest due to the species of medusae found in the deeper waters of the upper Continental Slope which are new or rare in Canadian Pacific waters. The most striking example, Merga reesi, has previously been described from a single specimen collected in a 820-m haul off the mouth of the English Channel (Russell 1956). We collected a single specimen at Station 23 (Fig. 1) off the northwest coast of Vancouver Island in a tow to 528 m depth. Three other species new to Canadian Pacific waters include Bythotiara depressa, Calycopsis nematophora, and Atolla vanhoeffeni. Species which have each only been recorded once before (see Arai and Brinckmann-Voss 1980 for the literature) include the Tiaropsidium species, Eirene mollis, Crossota rufobrunnea and Pantachogon haeckeli. Several narcomedusae and rhopalonematid trachymedusae were obtained which certainly differ from previously recorded species but which have been so damaged during collection that definite identification cannot yet be made.

Oblique tows with Bongo gear aimed at collection of ichthyoplankton do not usually catch sufficient medusae to allow quantitative estimation of their abundance. Additionally, despite tow conditions conducive to collection of fish larvae in excellent condition, the greater relative fragility of many medusae calls for even slower gear and vessel speeds during the tow. In the present study, many specimens were in too poor a condition to allow definite identification at the species level. Nevertheless, a qualitative picture of distributional trends for the more common medusae emerged from the ichthyoplankton survey.

Medusae were very rare in January, and in February were represented by small numbers of some deepwater species. In March, Aglantha digitale was present both off Vancouver Island and off the Queen Charlotte Islands, being most abundant in tows exceeding 200 m in depth, that is seaward of the shelf edge. In April, their numbers decreased off the Queen Charlotte Islands (Table 8 and 9 and Fig. 10 and 11). Another deepwater species, Solmissus marshalli, was taken in smaller numbers and, again, mostly in tows which exceeded 200 m in depth. In contrast, leptomedusae, particularly Eutonina indicans and Phialidium gregarium, became common on the shelf off Vancouver Island in March and April at depths less than 200 m (Table 8 and 9, Fig. 12 and 13).

Of the common medusae species, Aglantha digitale feeds primarily on copepods and secondarily on larvae of other invertebrate groups (Lebour 1922; Smedstad 1972, Williams and Conway 1981). The diet of Solmissus marshalli remains unknown. Zelickman (1976) states that Eutonina indicans is a non-selective plankton feeder. In the laboratory, Eutonina will eat the ctenophore Pleurobrachia, other medusae, and newly-hatched herring larvae (Arai and Jacobs 1980). Phialidium gregarium medusae chiefly consume copepods (McCormick 1969) but do eat newly-hatched herring larvae in culture (Arai and Hay, unpublished).

For fisheries management, the most important finding of the ichthyoplankton survey involved preliminary documentation of the spawning

grounds, seasonal timing, and hatching depths of the blackcod, Anaplopoma fimbria in Canadian waters. Blackcod larvae were principally collected in March and April in waters generally deeper than 400 m. Their greatest potential interaction with medusae there, although transitory, could potentially involve Aglantha digitale in terms of competition for food (copepods). Blackcod larvae ascend to surface waters and may be transported offshore or inshore, depending on the dynamics of the upper mixed layer (0-150 m). Onshore transport would expose them to developing populations of Eutonina, Phialidium, and ctenophores.

Siphonophores and ctenophores were not identified to species although spot checks made through the station catches showed that the common ctenophore was Pleurobrachia pileus var. bachei. This ctenophore was present in large numbers at in-shore stations off the west coast of Vancouver Island during March and April (Fig. 14 and 15). This would allow interaction with the larvae of rockfish species (Sebastes) which progressively increase in abundance in this area from January to April (unpublished material). Pleurobrachia are known to catch active fish larvae (e.g. laboratory experiments with larvae of the rockfish Agonus cataphractus by Greve 1972). However, Fraser (1970) and Hirota (1974) summarize their own data and previous literature, showing that fish eggs and larvae are only occasionally observed in the stomachs of wild Pleurobrachia. This ctenophore, like Aglantha digitale, may be most important as a food competitor with fish larvae since it feeds primarily on arthropods. Its interaction with copepods is complex since adult Pleurobrachia feed extensively on copepods whereas young ones can be damaged by large copepods (Greve 1972, 1977).

Table 9. Coelenterates from West Coast Cruises 1980

Hyphenated numbers indicate cruise and station number, followed by actual number of specimens in tow in brackets.

Phylum Cnidaria

Class Hydrozoa

No further identification possible 1-36(2), 1-37(1), 3-3(1), 3-16(1), 3-17(3), 3-19(1), 3-23(4), 3-33(1), 3-43(1), 4-1(6), 4-2(5), 4-3(2), 4-4(2), 4-5(1), 4-7(8), 4-8(4), 4-11(1), 4-12(2), 4-13(4), 4-15(9), 4-16(18), 4-19(16), 4-20(30), 4-21(2), 4-22(6), 4-23(6), 4-24(7), 4-26(1), 4-30(5), 4-31(15), 4-33(4), 4-35(3), 4-36(4), 4-37(4), 4-41(9), 4-42(8), 4-43(4), 4-49(12), 4-51(1), 4-52(1), 4-53(2), 4-54(4), 4-56(7), 4-57(1), 4-68(2).

Order Anthomedusae

No further identification possible 3-27(1), 4-14(1), 4-42(1).

Unidentified species, probably a calycopsid 3-8(1).

Family Tubularidae

Unidentified species (probably Euphysa japonica in part) 2-49(1), 2-50(1), 3-51(1), 3-52(10), 3-53(1), 3-54(4), 3-55(28), 3-65(1), 4-51(1), 4-52(7), 4-53(11), 4-55(9), 4-62(1).

Euphysa tentaculata 3-3(1).

Family Velellidae

Velella velella (hydroid) 3-15(1).

Family Corynidae

No further identification possible 3-3(1), 4-1(1).

Sarsia sp. 3-9(11), 3-12(1), 3-19(2), 3-21(1), 4-1(1), 4-12(5), 4-16(1), 4-17(1), 4-19(1), 4-20(1), 4-30(1), 4-57(1), 4-62(1).

Family Rathkeidae

Rathkea octopunctata 4-1(2), 4-59(1).

Family Pandeidae

Not identified further 4-4(1), 4-11(2), 4-12(1), 4-19(1), 4-20(1), 4-21(1), 4-25(1), 4-59(1).

Merga reesi 2-23(1).

Stomotoca atra 4-55(1).

Family Calycopsidae

Bythotiara depressa 2-48(1), 3-36(1), 3-40(1), 4-15(1), 4-33(1).

Calcyopsis nematophora 3-48(1), 4-42(1).

Order Leptomedusae

No further identification possible 3-2(1), 3-11(1), 3-13(3), 3-16(4), 3-17(6), 3-18(20), 3-19(4), 3-20(1), 3-21(5), 3-27(3), 3-50(1), 4-1(10), 4-2(12), 4-3(4), 4-4(2), 4-8(2), 4-9(1), 4-10(5), 4-11(20), 4-12(54), 4-13(6), 4-14(2), 4-16(6), 4-17(8), 4-19(114), 4-20(62), 4-21(5), 4-22(3), 4-23(9), 4-27(3), 4-28(9), 4-29(4), 4-30(52), 4-31(44), 4-52(1), 4-53(2), 4-54(9), 4-55(2), 4-56(31), 4-57(3), 4-61(1), 4-62(4), 4-69(1), 4-74(1).

Family Mitrocomidae

Unidentified species 3-27(1), 3-28(3), 3-33(1).

Mitrocoma cellularia 3-19(1), 3-73(1), 4-2(1), 4-18(3), 4-19(3), 4-23(2), 4-26(1), 4-27(1), 4-29(1), 4-30(1), 4-56(2), 4-57(1).

Tiaropsidium sp. 4-17(1).

Family Campanularidae

Obelia spp. 4-1(1).

Phialidium gregarium 3-12(1), 3-19(2), 3-20(1), 3-21(6), 3-27(2), 4-1(15), 4-2(18), 4-3(3), 4-7(1), 4-10(1), 4-11(2), 4-12(25), 4-13(2), 4-14(1), 4-15(1), 4-16(1), 4-18(17), 4-19(80), 4-20(7), 4-21(1), 4-23(3), 4-27(1), 4-28(1), 4-30(2), 4-31(2), 4-51(1), 4-56(8), 4-73(1).

Family Eirenidae

Eirene mollis 4-2(1).

Family Eutimidae

Eutonina indicans, see Table 9.

Family Aequoridae

Aequorea victoria 4-18(1).

Order Limnomedusae

Family Proboscidactylidae

Proboscidactyla flavicirrata 3-2(1), 3-19(1), 3-21(1), 4-8(1), 4-11(1), 4-12(2), 4-13(4), 4-16(1), 4-21(1), 4-25(1), 4-27(2), 4-28(1), 4-37(1), 4-51(1), 4-52(2), 4-54(1), 4-55(1), 4-56(2), 4-57(5), 4-62(4).

Order Trachymedusae

No further identification possible 2-15(1), 3-15L(2), 3-16(1), 3-37(1), 3-42(2), 3-43b(1), 3-48(2), 4-7(1), 4-8(1), 4-16(2), 4-37(3), 4-48(1), 4-49(2).

Family Rhopalonematidae

Unidentified species no. 1. 2-7(2), 2-15(1), 2-48(2), 2-49(1), 3-23(1), 3-24(1), 3-36(1), 3-37(1), 3-41(3), 3-43b(2), 4-7(2), 4-15(6), 4-23(1), 4-33(1), 4-42(2), 4-49(3).

Unidentified species no.. 2. 2-16(1), 3-15(1), 4-7(1).

Unidentified species no. 3. 2-16(3), 3-15(1), 4-7(1), 4-8(1), 4-15(2), 4-42(2)

Unidentified species no. 4. 3-37(1).

Unidentified species no. 5. 4-1(1).

Aglantha digitale 1-37(2), 2-16(1), 2-23(1), 2-37(1), 2-42(1), 2-48(9), 2-50R(4). See Table 9 for cruises 3 and 4.

Crossota sp. 4-49(1).

Crossota rufobrunnea 3-43b(1).

Pantachogon haeckeli 2-7(2), 2-16(3), 2-42(1).

Order Narcomedusae

No further identification possible 3-3(1), 3-16(5), 3-22(1), 4-7(2), 4-8(1), 4-14(4), 4-15(6), 4-16(1), 4-22(9), 4-23(6), 4-33(3), 4-37(1), 4-42(1), 4-68(1).

Unidentified species no. 1. 3-21(1), 4-28(1).

Unidentified species no. 2. 3-21(1), 4-3(1), 4-23(1).

Unidentified species no. 3. 3-23(1).

Unidentified species no. 4. 3-44(1).

Family Aeginidae

Unidentified species 2-16(1), 3-16(1).

Aegina citrea 1-36(1), 2-23(1), 3-15(1), 4-2(1).

Family Cuninidae

Solmissus marshalli 2-16(5), 2-23(9), 2-29(1), 2-37(3), 2-42(3), 2-48(3), 2-50(1), 2-50R(3), 3-23(9), 3-24(4), 3-33(5), 3-36(1), 3-37(4), 3-41(3), 3-43(3), 3-53(5), 4-1(1), 4-2(3), 4-7(1), 4-8(2), 4-14(2), 4-15(1), 4-22(4), 4-23(1), 4-33(1), 4-42(2).

Order Siphonophora (not identified further)

Colonies 3-15(1), 3-15R(9), 3-23(1), 3-33(2), 3-64(1), 4-36(2), 4-42(2).

Individuals and bracts 1-8(1), 1-36(8), 2-16(16), 2-23(9), 2-37(6), 2-42(2), 2-48(1), 2-50(7), 2-50R(6), 3-2(5), 3-7(32), 3-8(14), 3-9(1), 3-10(1), 3-13(3), 3-14(11), 3-15(47), 3-15R(66), 3-16(25), 3-17(1), 3-19(3), 3-21(1), 3-22(1), 3-23(57), 3-24(1), 3-33(73), 3-35(2), 3-36(3), 3-37(21), 3-40(28), 3-41(10), 3-42(13), 3-43(21), 3-43a(2), 3-43b(8), 4-47(1), 3-48(9), 3-49(5), 3-53(8), 3-54(13), 3-55(1), 3-63(2), 4-1(9), 4-2(19), 4-3(2), 4-4(2), 4-7(115), 4-8(47), 4-11(7), 4-12(3), 4-13(5), 4-14(5), 4-15(32), 4-16(12), 4-17(3), 4-18(1), 4-19(1), 4-21(4), 4-22(1), 4-23(3), 4-24(4), 4-26(2), 4-30(1), 4-31(1), 4-33(12), 4-36(3), 4-37(8), 4-41(7), 4-42(8), 4-43(3), 4-48(1), 4-49(13), 4-50(1), 4-51(1), 4-52(3), 4-53(9), 4-54(10), 4-55(6), 4-56(1), 4-58(2), 4-62(9), 4-68(4).

Class Scyphozoa

Order Coronatae

No further identification possible 3-8(1), 3-48(1), 4-2(1), 4-8(1).

Family Atollidae

Atolla vanhoeffeni 1-15(1), 2-15(1), 2-48(1), 2-49(1), 3-8(1), 3-36(1), 4-8(1).

Family Periphyllidae

Periphylla periphylla 1-36(1), 1-37(1), 2-37(1), 3-8(1), 3-33(1), 4-7(1), 4-8(1), 4-49(1).

Order Semaeostomae

Ephyrae 4-2(1), 4-21(1).

Phylum Ctenophora

Class Tentaculata

Order Cydippida (not identified further)
1-15(1), 2-16(1). See Table 9 for cruises 3 and 4.

Order Lobata (not identified further)
3-12(4).

Class Nuda

Order Beroida (not identified further)
2-20(1), 2-23(1), 2-29(1), 2-50(1), 3-12(1), 3-20(1), 3-31(1), 4-47(1).

Table 10. Most abundant coelenterates and ctenophores from West Coast Cruises 3 and 4, 1980.

Cruise	Station	Day	Mo.	Ctenophores (Cydippida) #/10m^2	Aglantha #/10m^2	Eutonina #/10m^2
WC-3	1	12	03	116	9	49
	2	12	03	4	0	17
	3	12	03	0	4	8
	4	12	03	0	5	5
	5	12	03	0	0	0
	6	12	03	0	0	0
	7	12	03	14	14	0
	8	12	03	0	15	0
	9	12	03	0	0	0
	10	12	03	0	0	0
	11	13	03	1	0	0
	12	13	03	158	0	2
	13	13	03	335	0	16
	14	13	03	0	0	0
	15	13	03	0	191	0
	16	13	03	0	0	28
	17	13	03	32	0	43
	18	13	03	729	0	148
	19	13	03	941	6	30
	20	13	03	39	0	5
	21	13	03	20	0	0
	22	13	03	77	10	5
	23	14	03	0	76	7
	24	14	03	0	133	0
	25	14	03	63	0	0
	26	14	03	169	0	0
	27	14	03	359	4	4
	28	19	03	257	0	10
	29	19	03	66	0	0
	30	19	03	0	0	0
	31	19	03	12	0	0
	32	14	03	0	0	0
	33	14	03	18	66	0
	34	14	03	0	0	0
	35	14	03	0	0	0
	36	14	03	0	9	0
	37	15	03	0	92	0
	38	15	03	0	12	0
	39	15	03	0	0	0
	40	15	03	0	13	0
	41	15	03	0	42	0
	42	15	03	0	28	0
	43	15	03	0	16	0
	43A	15	03	0	0	0
	43B	15	03	0	83	0
	44	15	03	0	0	0
	45	16	03	0	0	0
	46	16	03	0	0	0

Table 10 (cont'd)

Cruise	Station	Day	Mo.	Ctenophores (Cydippida) #/10m^2	Aglantha #/10m^2	Eutonina #/10m^2
	47	16	03	0	0	0
	48	16	03	0	27	0
	49	16	03	0	8	0
	50	16	03	0	0	0
	51	16	03	0	0	0
	52	17	03	0	0	0
	53	17	03	0	0	0
	54	17	03	0	14	0
	55	17	03	0	0	0
	56	17	03	0	0	0
	57	17	03	0	0	0
	58	17	03	0	0	0
	59	17	03	0	0	0
	60	17	03	0	0	0
	61	17	03	0	0	0
	62	18	03	24	0	0
	63	18	03	0	2	0
	64	18	03	0	0	0
	65	18	03	0	0	0
	66	18	03	0	0	0
	67	18	03	0	0	0
	68	18	03	21	0	0
	69	18	03	0	0	0
	70	18	03	0	0	0
	71	18	03	0	0	0
	72	19	03	17	0	0
	73	19	03	0	0	0
	74	19	03	6	0	0
	75	19	03	102	0	0

Table 10 (cont'd)

Cruise	Station	Day	Mo.	Ctenophores (Cydippida) #/10m^2	Aglantha #/10m^2	Eutonina #/10m^2
WC-4	1	15	04	759	0	26
	2	15	04	929	0	57
	3	16	04	8	8	0
	4	16	04	170	9	0
	5	16	04	12	0	0
	6	16	04	42	0	0
	7	16	04	8	126	0
	8	16	04	14	41	0
	9	16	04	224	6	0
	10	16	04	136	26	0
	11	16	04	186	25	5
	12	17	04	3182-	17	0
	13	17	04	894	11	0
	14	17	04	16	5	0
	15	17	04	600	56	6
	16	17	04	334	12	17
	17	17	04	1545-	5	56
	18	17	04	1019-	0	22
	19	17	04	4550-	18	268
	20	17	04	1339-	2	11
	21	17	04	416	0	44
	22	17	04	491	7	14
	23	17	04	361	84	17
	24	18	04	8	8	0
	25	18	04	75	0	0
	26	17	04	228	0	0
	27	17	04	166	0	0
	28	23	04	38	0	0
	29	23	04	42	0	26
	30	23	04	50	0	264
	31	23	04	93	0	111
	32	23	04	0	6	0
	33	22	04	0	62	0
	34	18	04	0	0	0
	35	18	04	0	5	0
	36	18	04	0	32	0
	37	19	04	0	30	0
	38	19	04	0	0	0
	39	19	04	0	0	0
	40	19	04	0	0	0
	41	19	04	0	0	0
	42	19	04	0	54	0
	43	19	04	0	7	0
	43A	19	04	0	0	0
	43B	19	04	0	0	0
	44	19	04	0	0	0
	45	19	04	0	0	0
	46	19	04	0	0	0

Table 10 (cont'd)

Cruise	Station	Day	Mo.	Ctenophores (Cydippida) #/10m^2	Aglantha #/10m^2	Eutonina #/10m^2
	47	19	04	0	0	0
	48	20	04	0	0	0
	49	20	04	0	63	0
	50	20	04	0	5	0
	51	20	04	0	0	6
	52	20	04	0	0	6
	53	20	04	0	0	10
	54	20	04	0	0	9
	55	20	04	0	0	0
	56	20	04	0	0	212
	57	20	04	0	0	0
	58	21	04	5	0	0
	59	21	04	0	0	0
	60	21	04	0	0	0
	61	21	04	0	0	0
	62	21	04	0	0	0
	63	21	04	0	0	0
	64	21	04	0	0	0
	65	21	04	0	0	0
	66	21	04	0	0	0
	67	21	04	0	0	0
	68	21	04	0	6	0
	69	22	04	0	0	0
	70	22	04	0	0	0
	71	22	04	7	0	0
	72	22	04	0	0	0
	73	22	04	9	0	0
	74	22	04	7	0	0
	75	22	04	0	0	0

PART III. WEST COAST ZOOPLANKTON

West Coast Zooplankton

In January (Fig. 17) and in February (Fig. 18) zooplankton was abundant only in deep water along the edge of the shelf and in the submarine canyon cutting into the shelf at Dixon Entrance. Catches in deep water at the edge of the shelf were typically between 10-100 g/10 m^2 and 90% or more composed of Neocalanus plumchrus stage 5. The only exception to this was at station 68 in January where the catch (40.2 g/10 m^2) was 90% chaetognaths (Sagitta elegans).

In March (Fig. 19) only two shallow stations in Hecate Strait had less than 5.0 g/10 m^2. At all but six stations, the dominant organism was N. plumchrus stage 4 and 5. Stations 46, 47, 67, and 71 contained over 50% Limacina helicina; Station 63 was 80% barnacle nauplii and station 58 was over 80% S. elegans.

In April (Fig. 20) there was less zooplankton in the shallow water of Hecate Strait and Queen Charlotte Sound and a number of stations where phytoplankton clogging of the nets was apparent. The high biomass at other stations was chiefly N. plumchrus stage V. Despite the evident biomass increases shoreward as the spring progressed, the upper slope stations maintained the highest zooplankton stocks.

This is the first detailed quantitative study of the spring bloom on the Pacific continental shelf of Canada. Overwintering N. plumchrus stage 5 were apparent in deep water in January and February. The absence of mature specimens indicates that maturation takes place in water deeper than we sampled (500 m). The mesh size of the net (351 μ) does not capture nauplii and early copepodite stages of N. plumchrus but the appearance of stage 4 in March indicates that the timing of recruitment must be similar to the timing in the Strait of Georgia (Fulton 1973). The biomass maximum in the order of 40-50 g/m^2 is about half of the value for the Strait of Georgia spring bloom which is about 84 g/m^2 (see Harrison et al. 1982) but about four times higher than that of the open ocean (about 10 g/m^2 - Fulton 1978).

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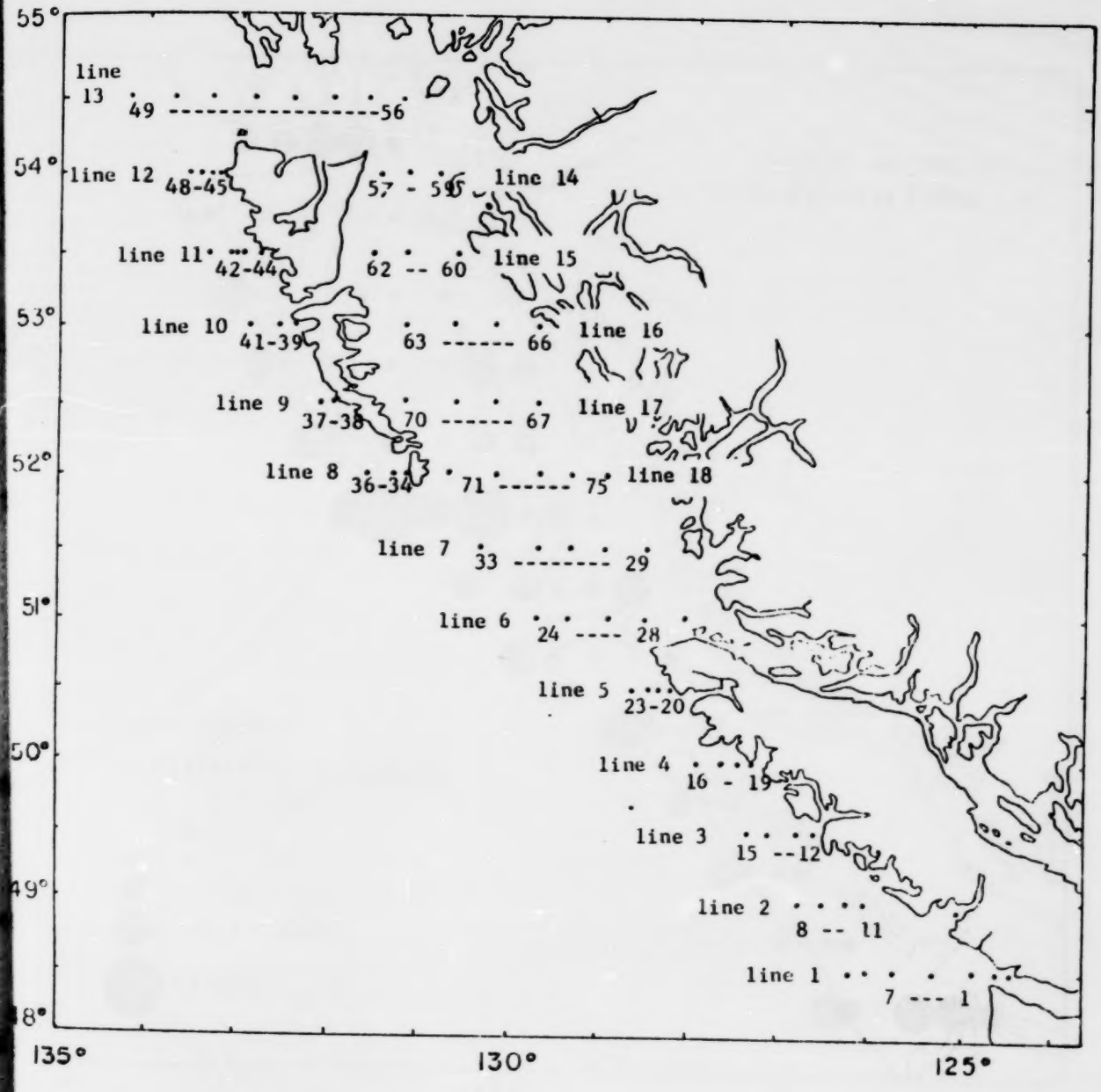

FIGURE 1. Tracklines and associated stations in numbered sampling sequence for the West Coast Ichthyoplankton Survey, January through April, 1980.

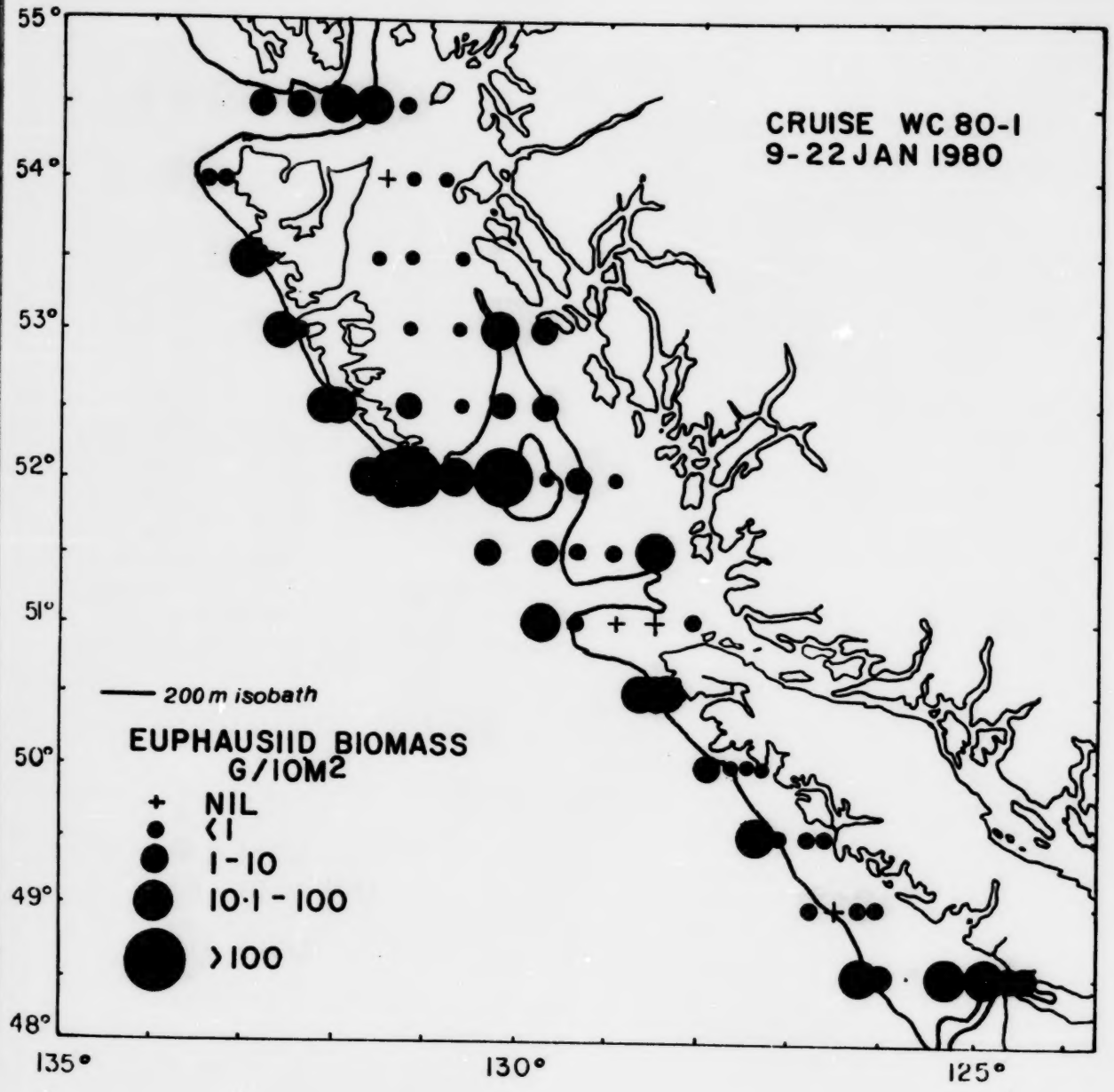

Figure 2. Distribution of euphausiid biomass - January.

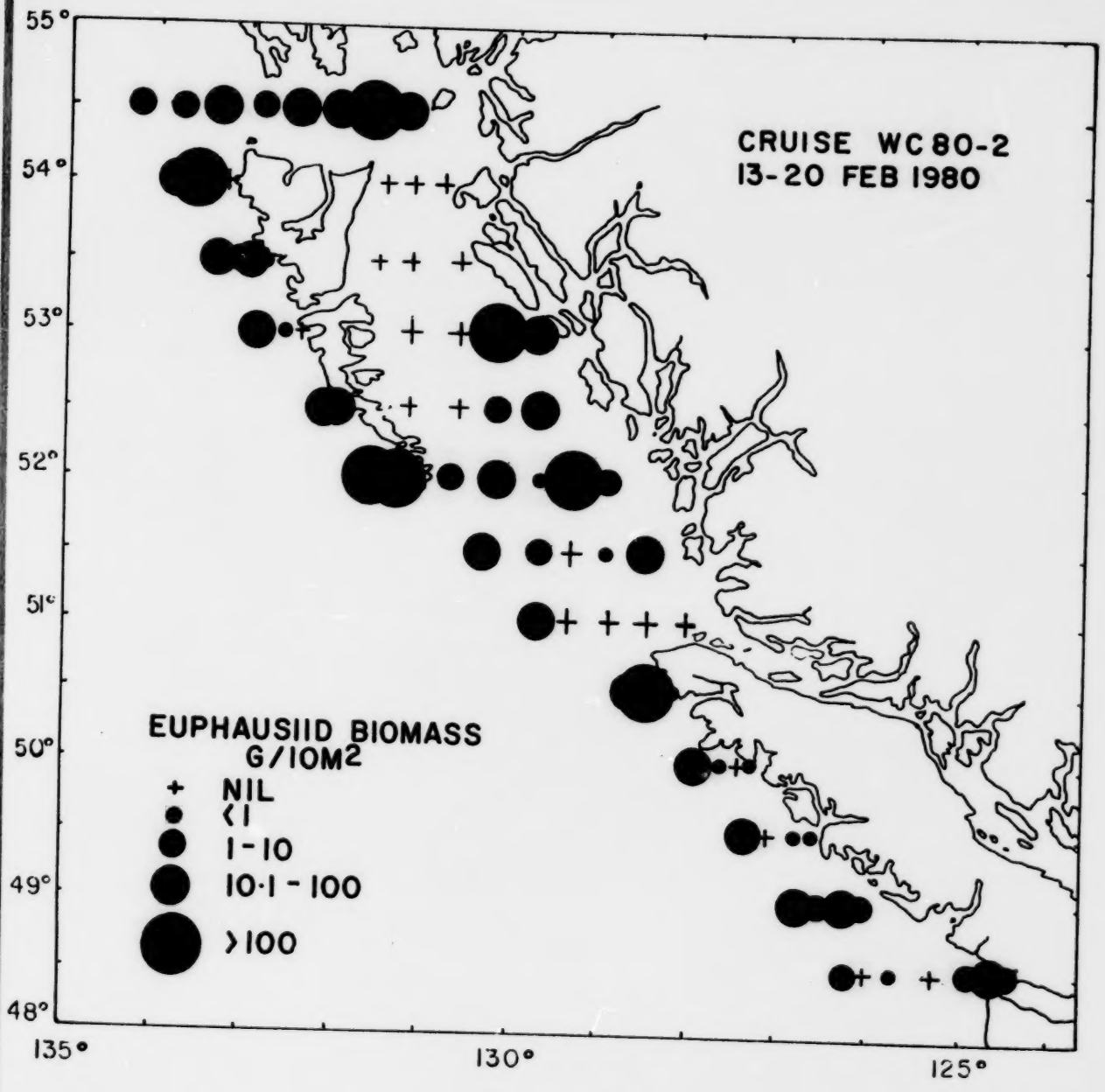

Figure 3. Distribution of euphausiid biomass - February.

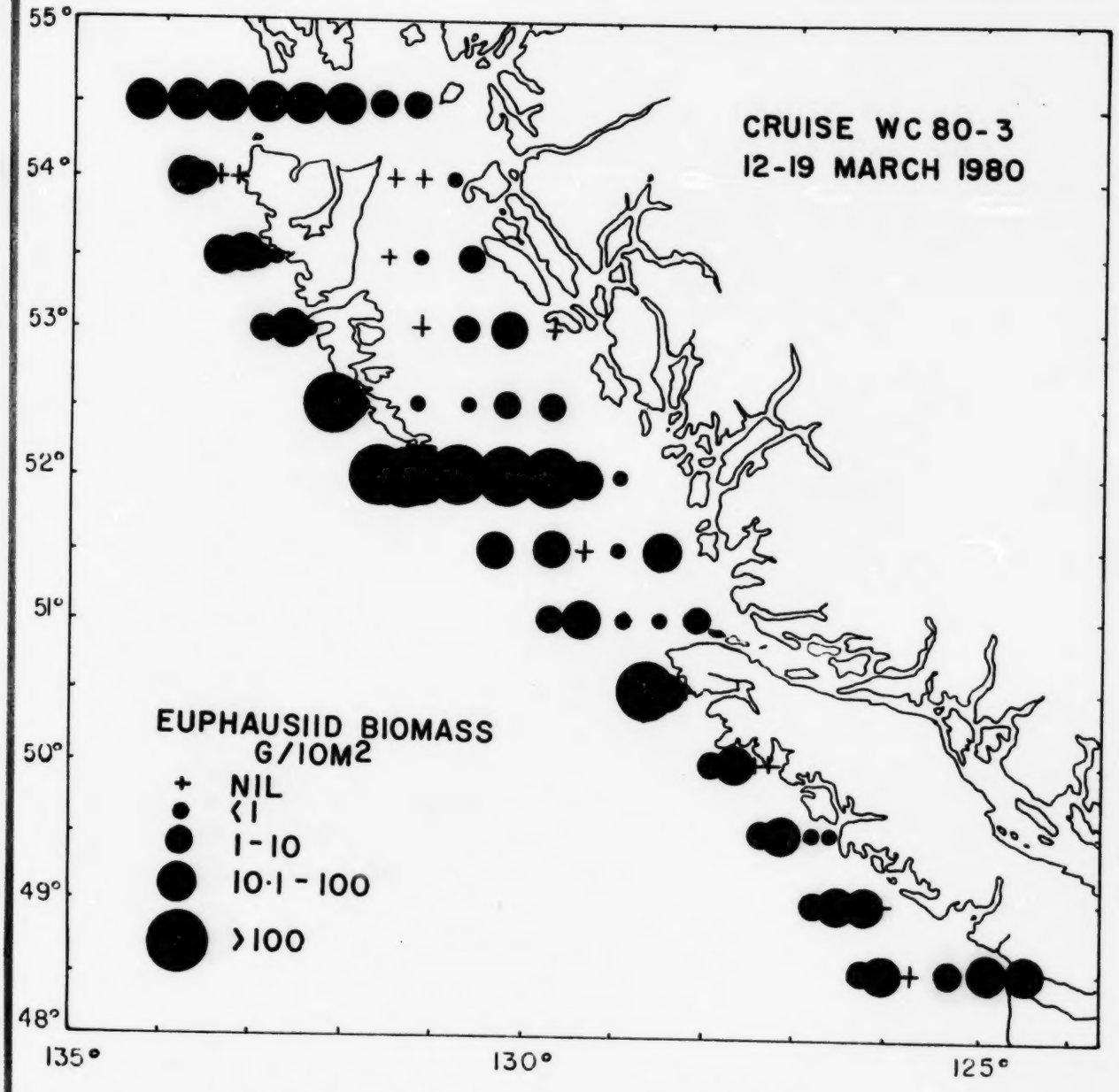

Figure 4. Distribution of euphausiid biomass - March.

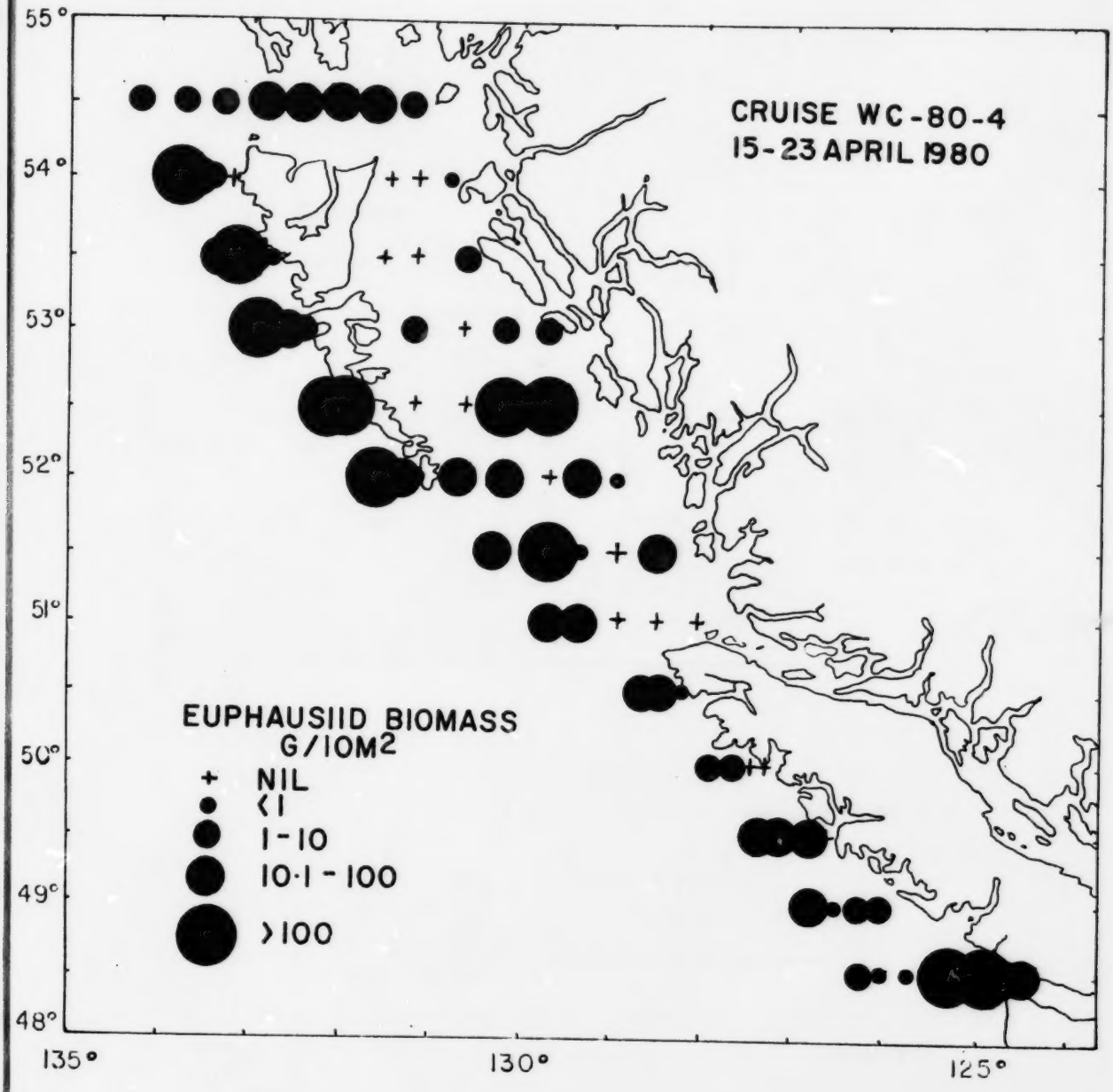

Figure 5. Distribution of euphausiid biomass - April.

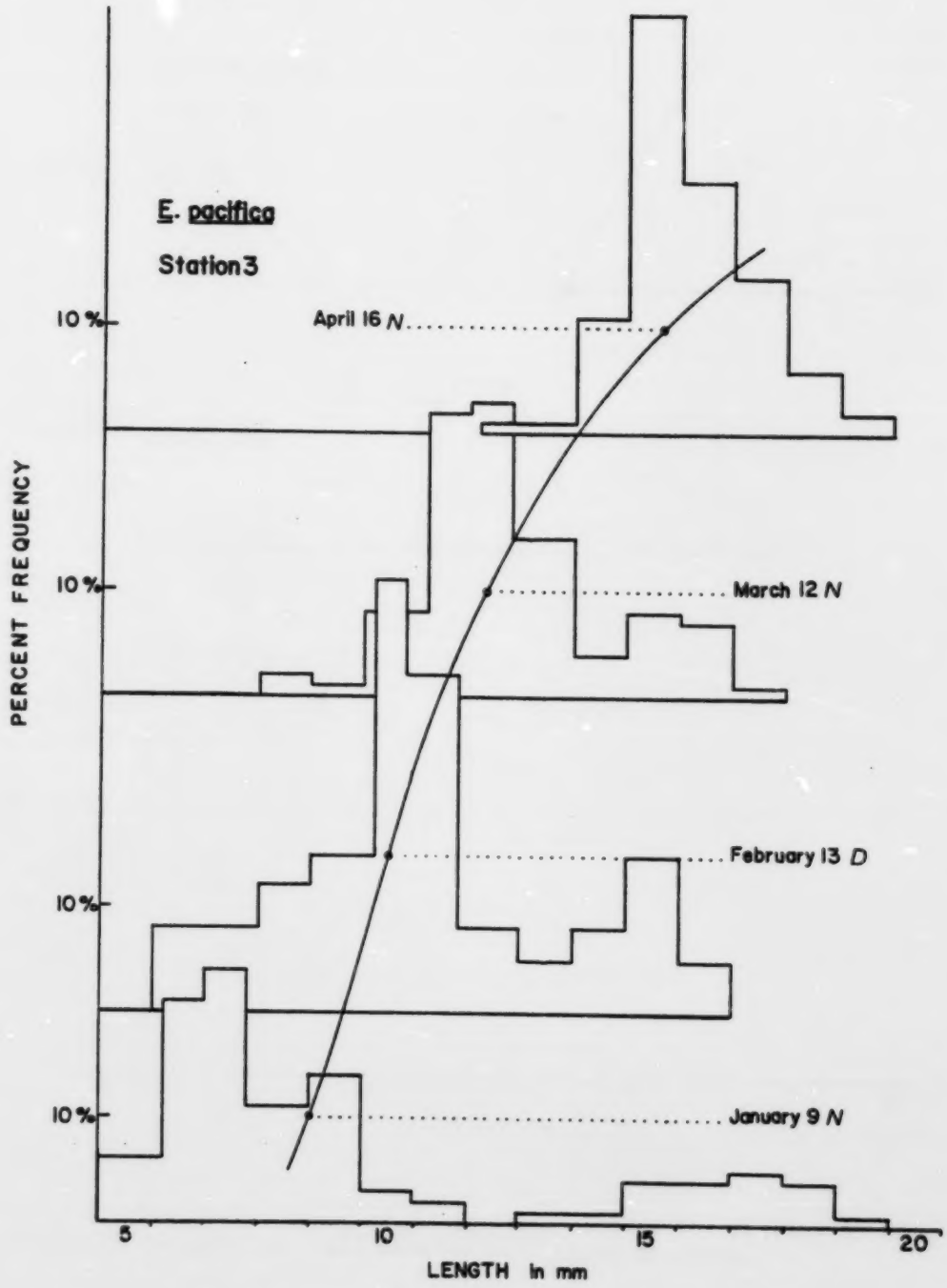

Figure 6. Length-frequency of E. pacifica plotted for station 3 from January 9 to April 16. "N" indicates night sampling, "D" - day sampling.

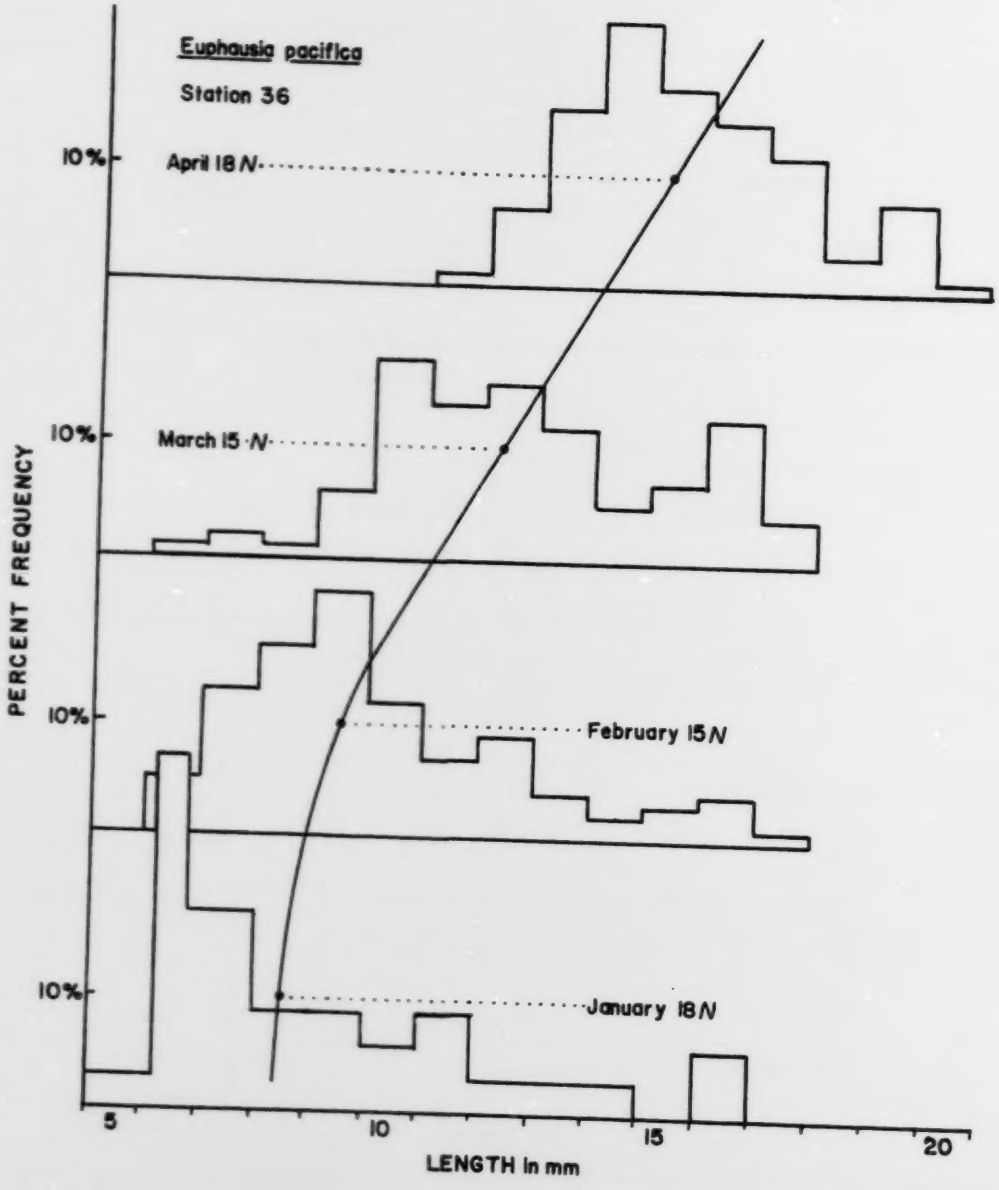

Figure 7. Length-frequency of E. pacifica plotted for station 36 from January 18 to April 18. All samples were taken at night.

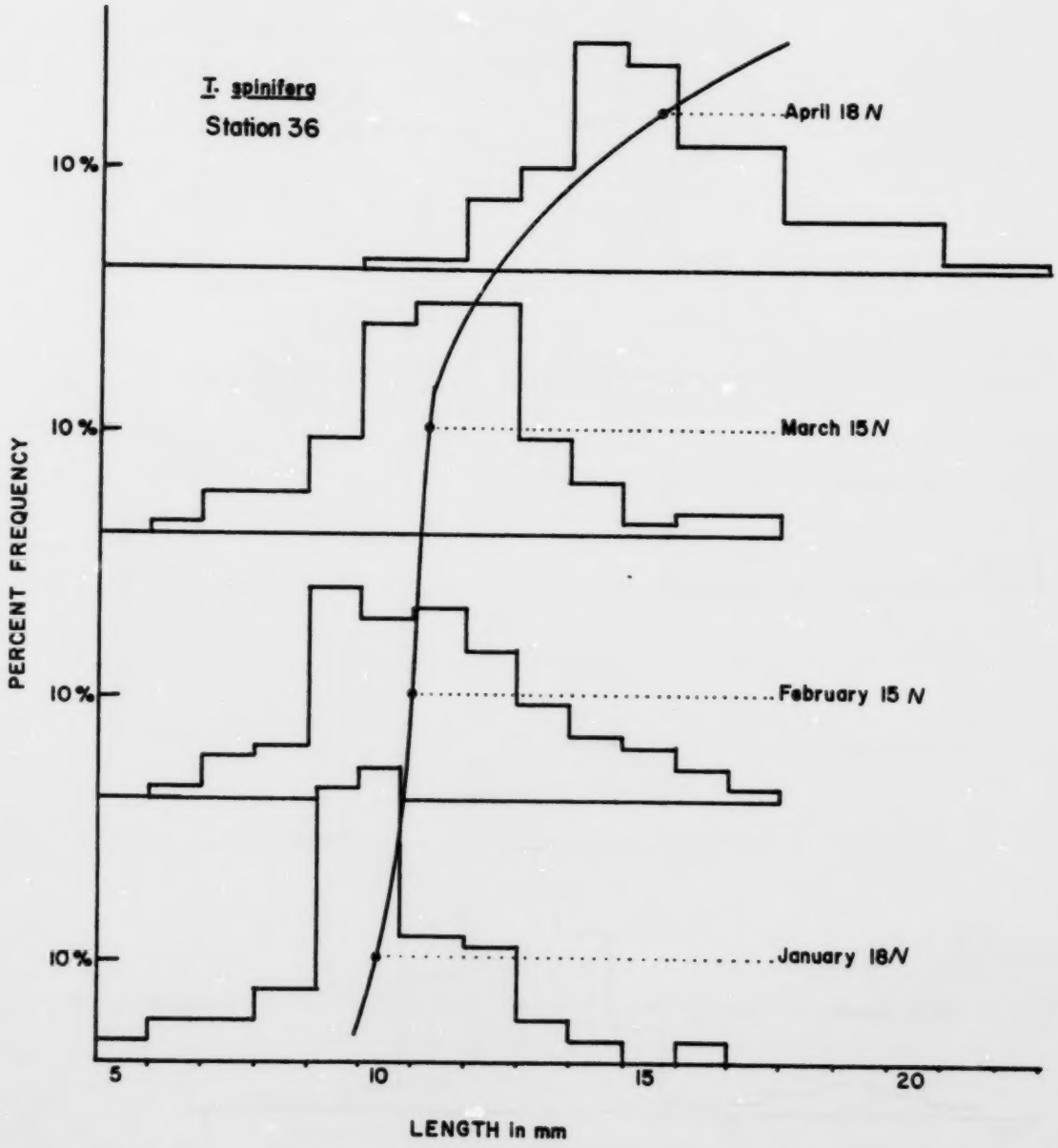

Figure 8. Length-frequency of T. spinifera plotted for station 36 from January 18 to April 18. All samples were taken at night.

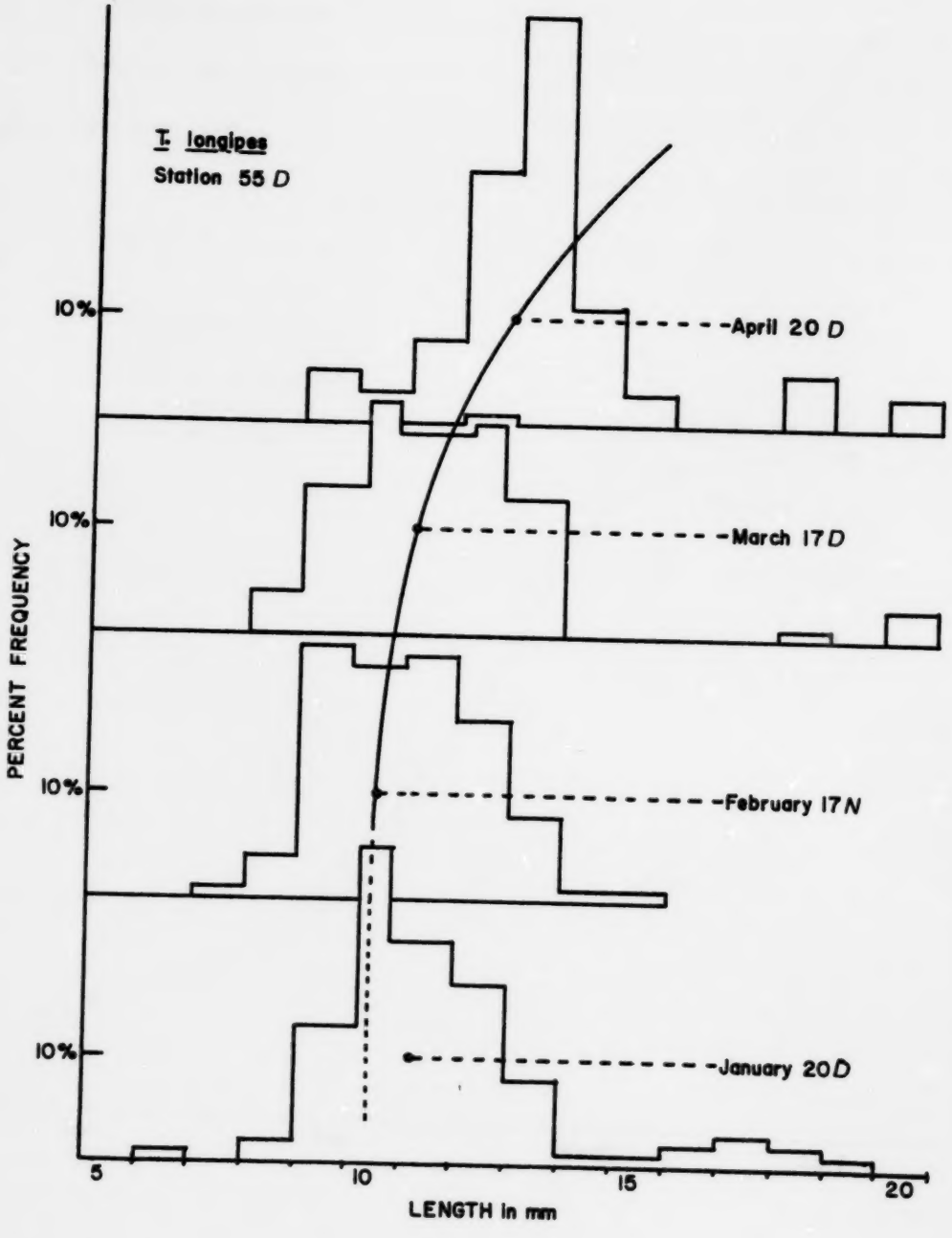

Figure 9. Length-frequency of T. longipes plotted for station 55 from January 20 to April 20. "N" indicates night sampling, "D" - day sampling.

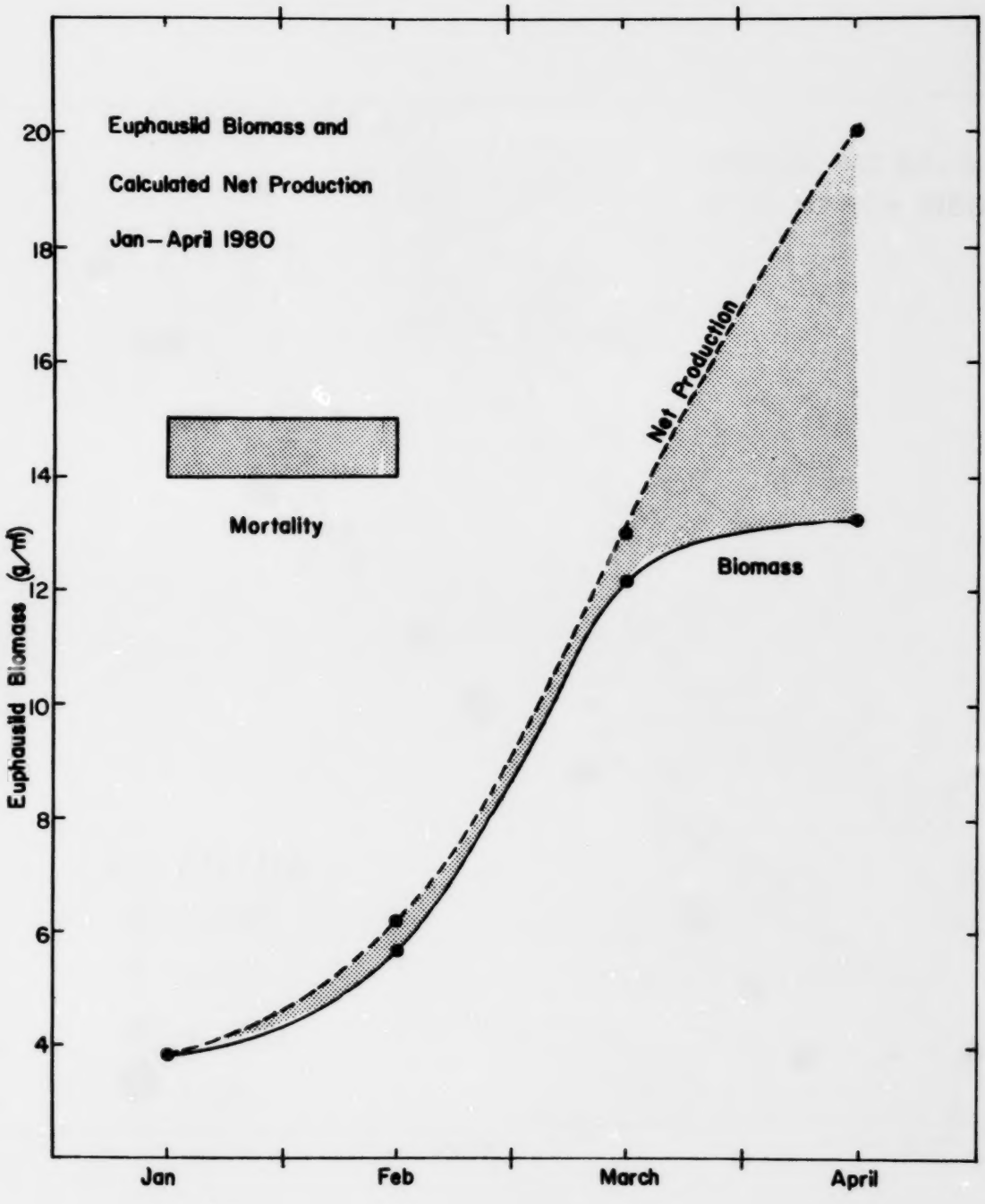

Figure 10. Euphausiid biomass, calculated net production, and mortality from January to April 1980 for the west coast shelf waters deeper than 200 m.

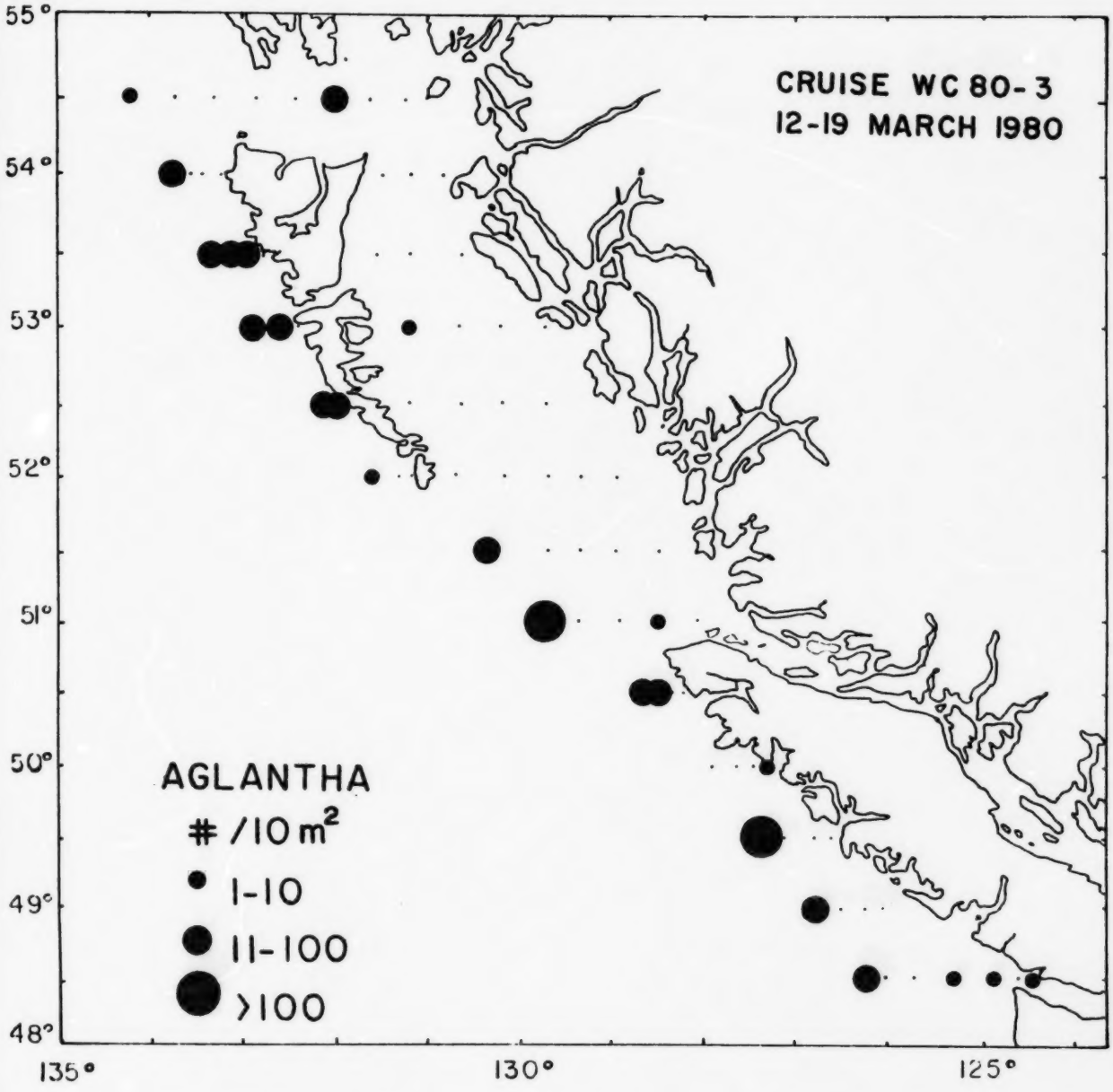

Figure 11. Distribution of Aglantha - March in numbers/10 m^2.

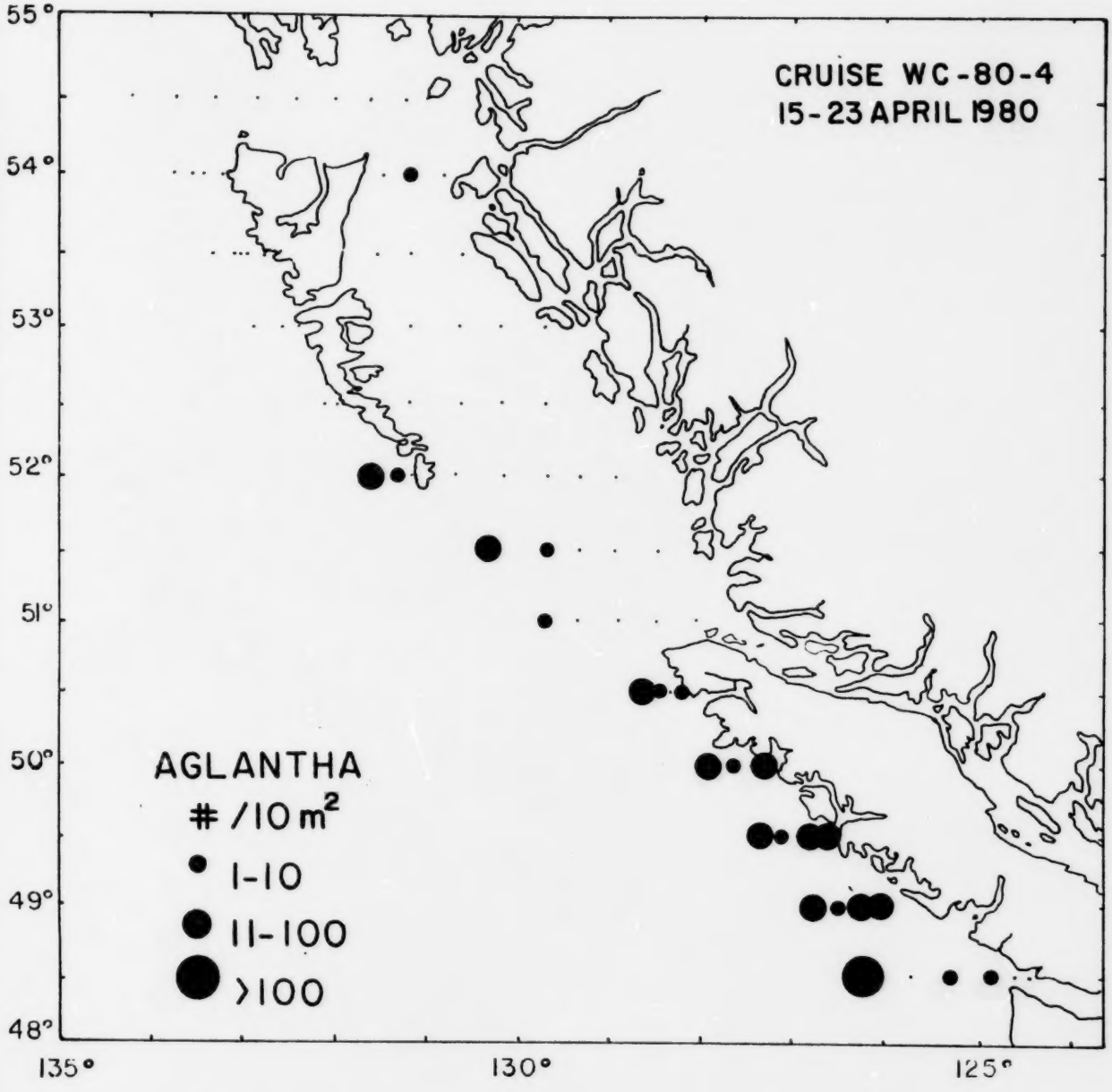

Figure 12. Distribution of Aglantha - April in numbers/10 m^2.

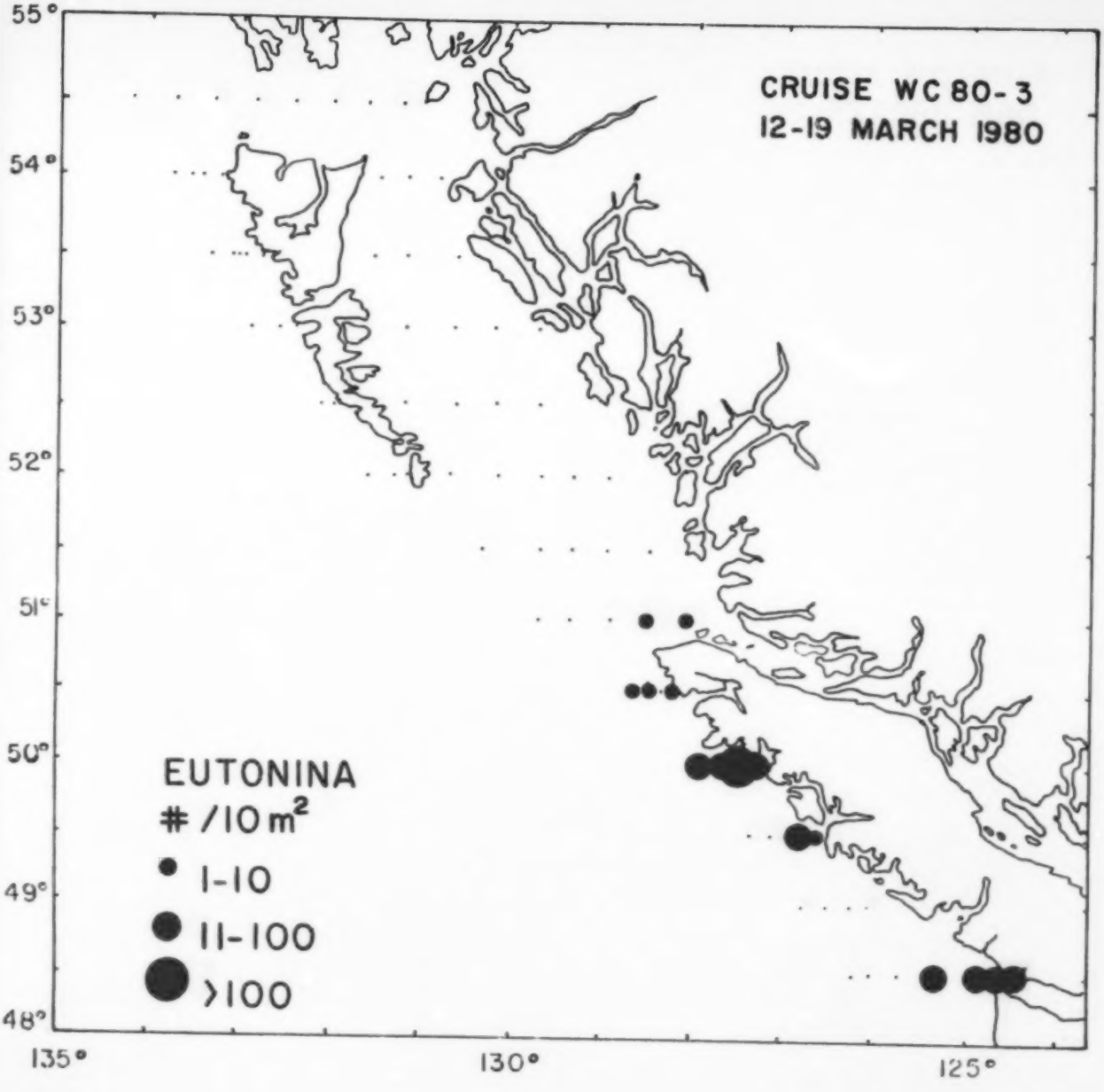

Figure 13. Distribution of Eutonina - March in numbers/10 m^2.

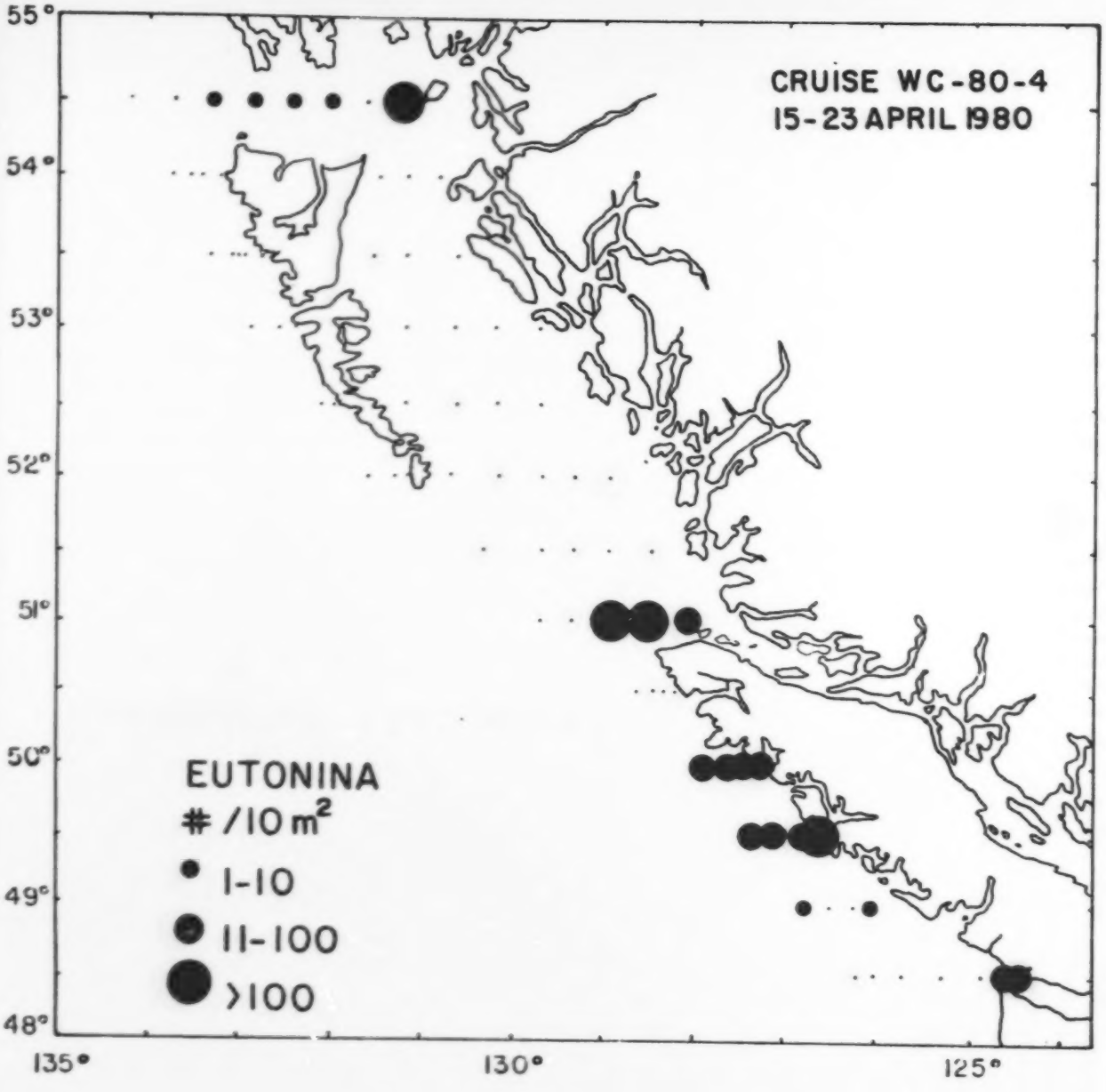

Figure 14. Distribution of Eutonina - April in numbers/10 m^2.

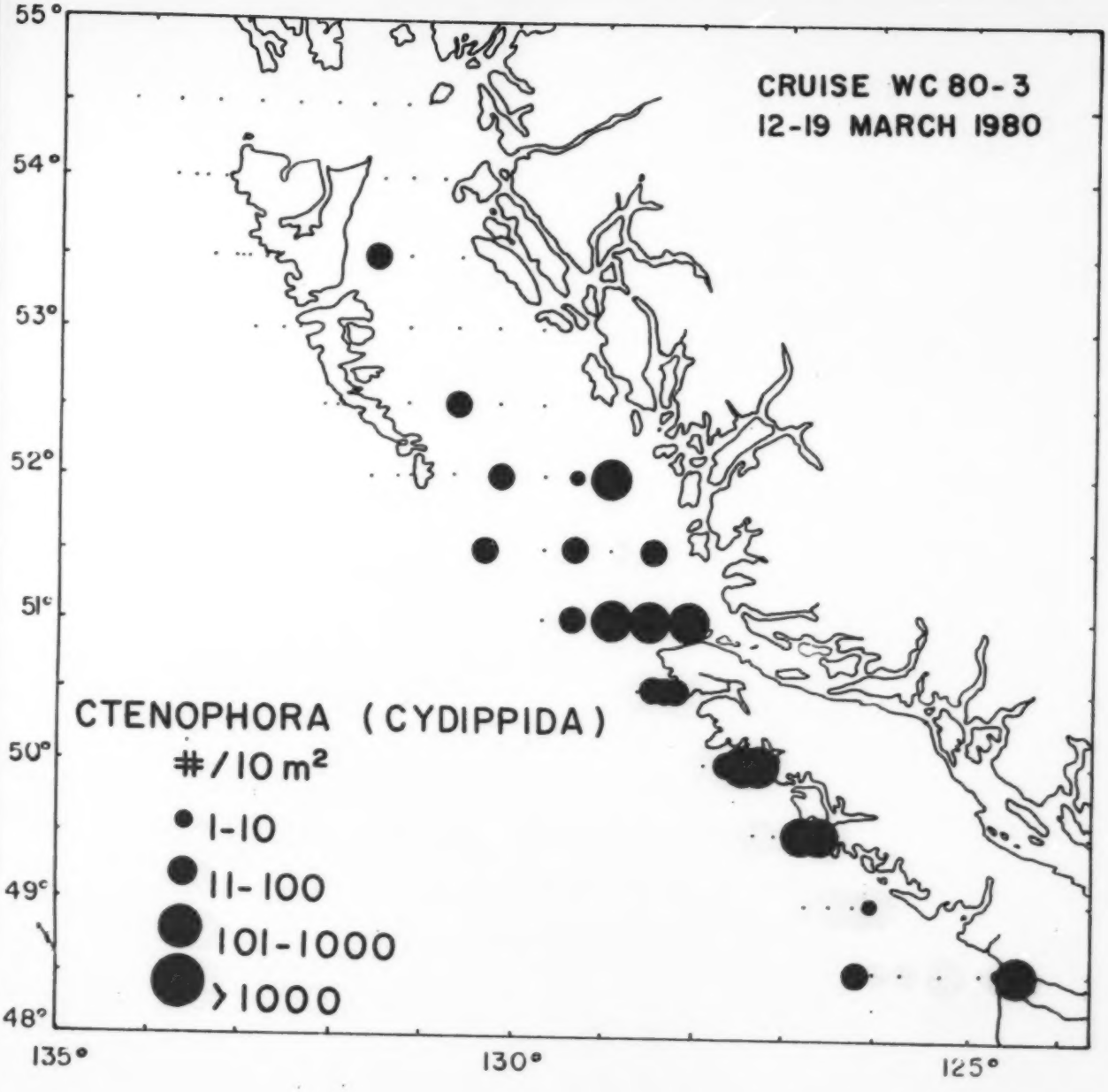

Figure 15. Distribution of Ctenophores (Cydippida) - March in numbers/10 m^2.

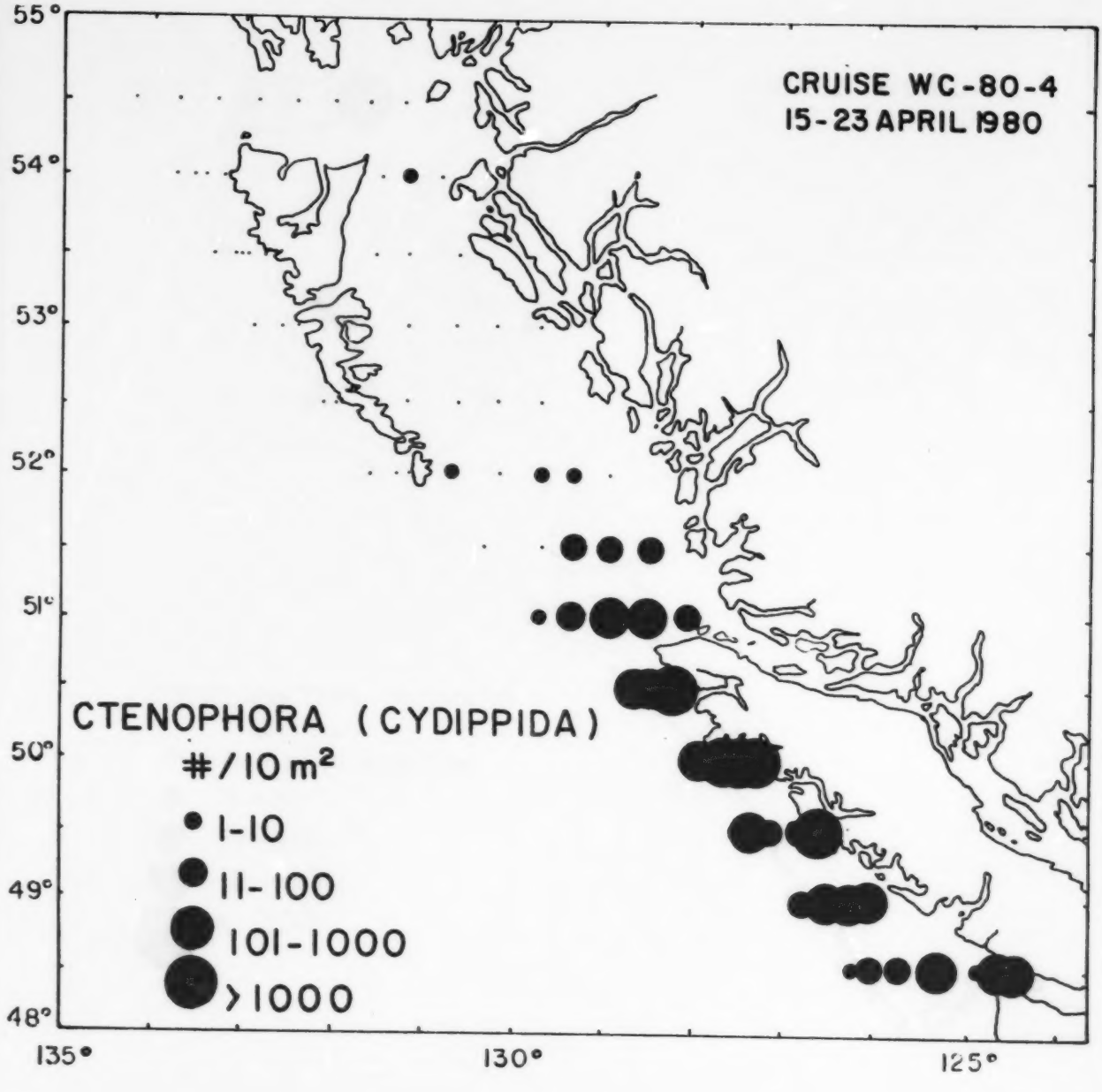

Figure 16. Distribution of Ctenophores (Cydippida) - April in numbers/10 m^2.

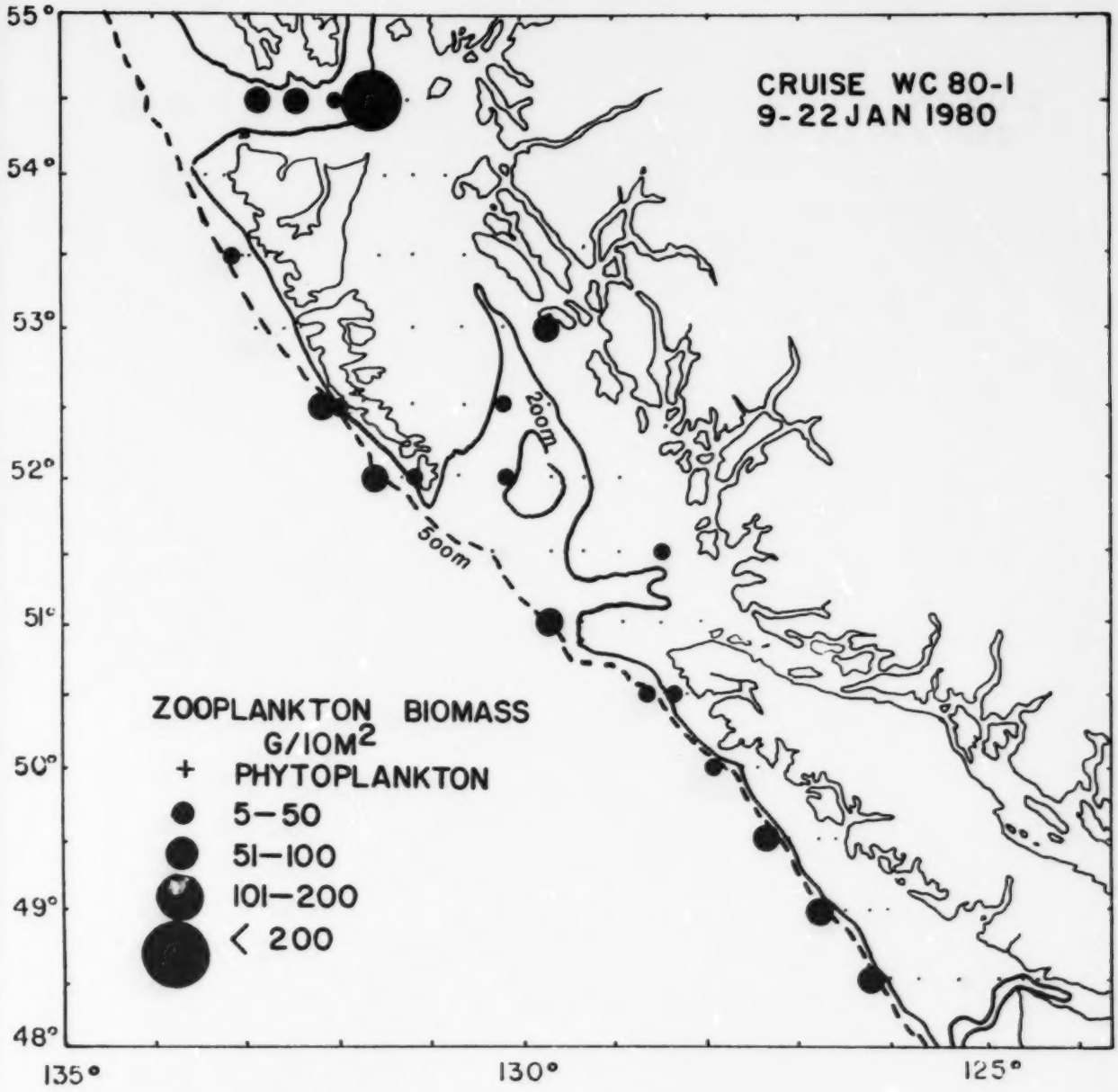

Figure 17. Distribution of zooplankton biomass - January.

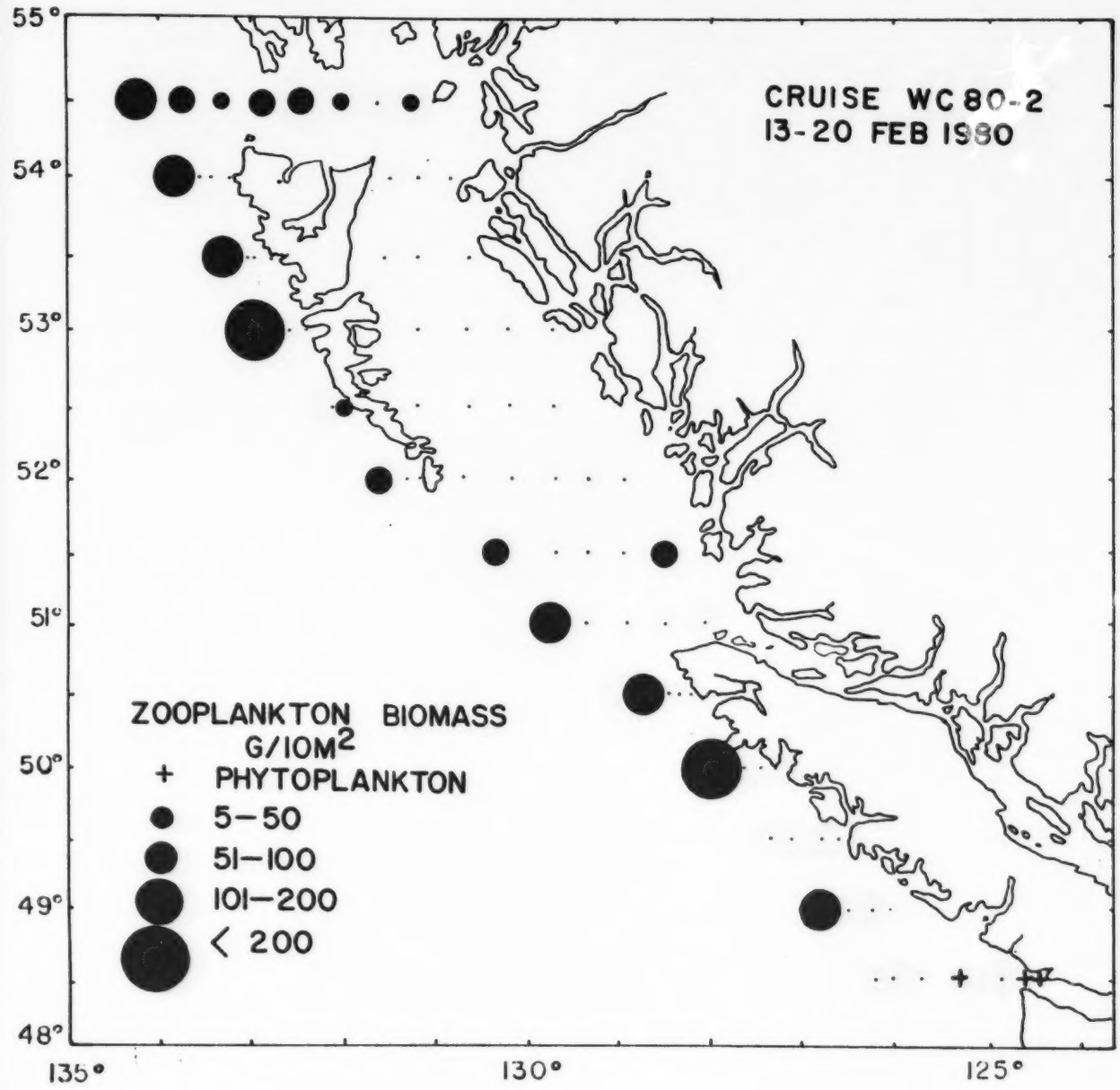

Figure 18. Distribution of zooplankton biomass - February.

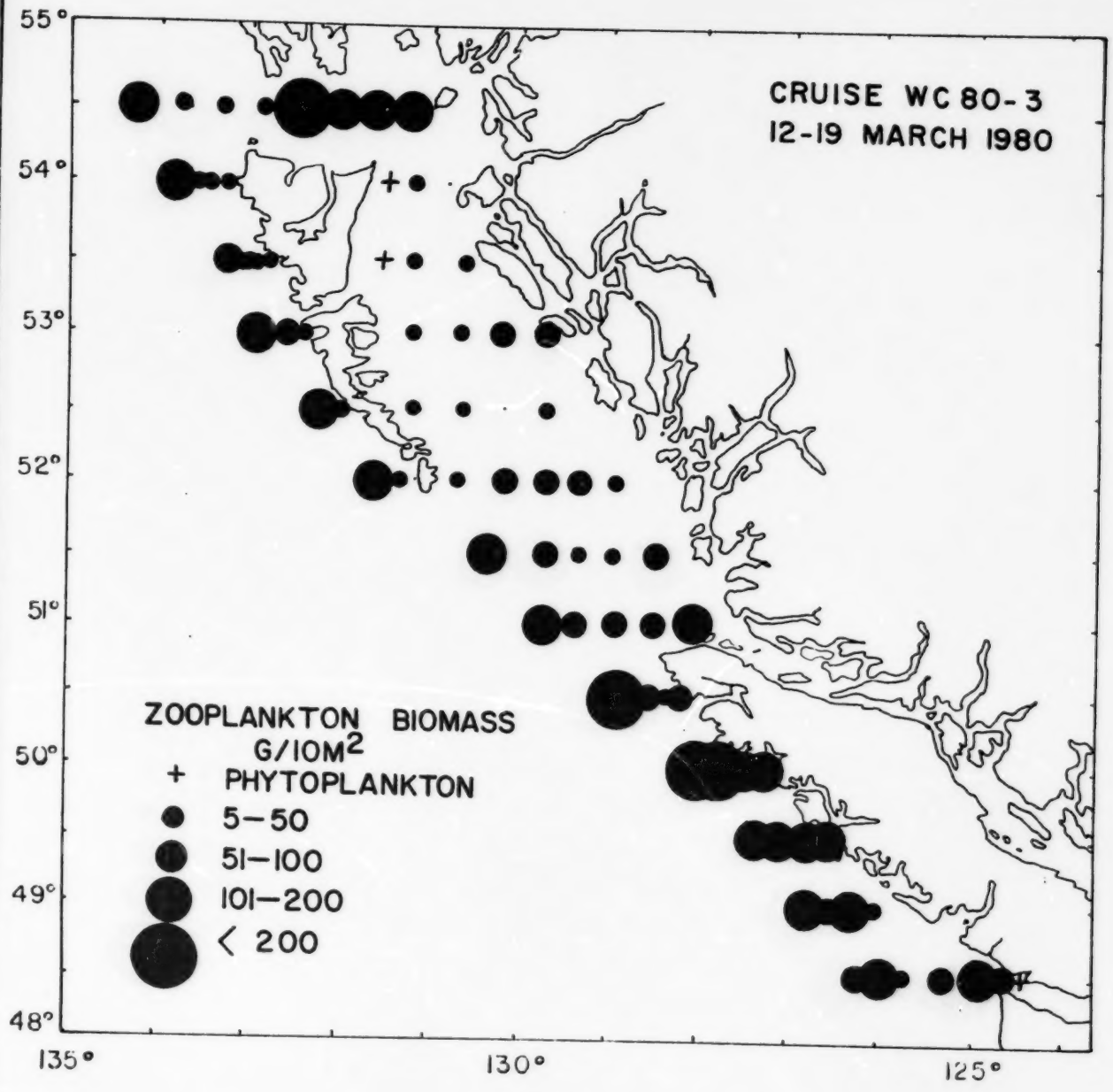

Figure 19. Distribution of zooplankton biomass - March.

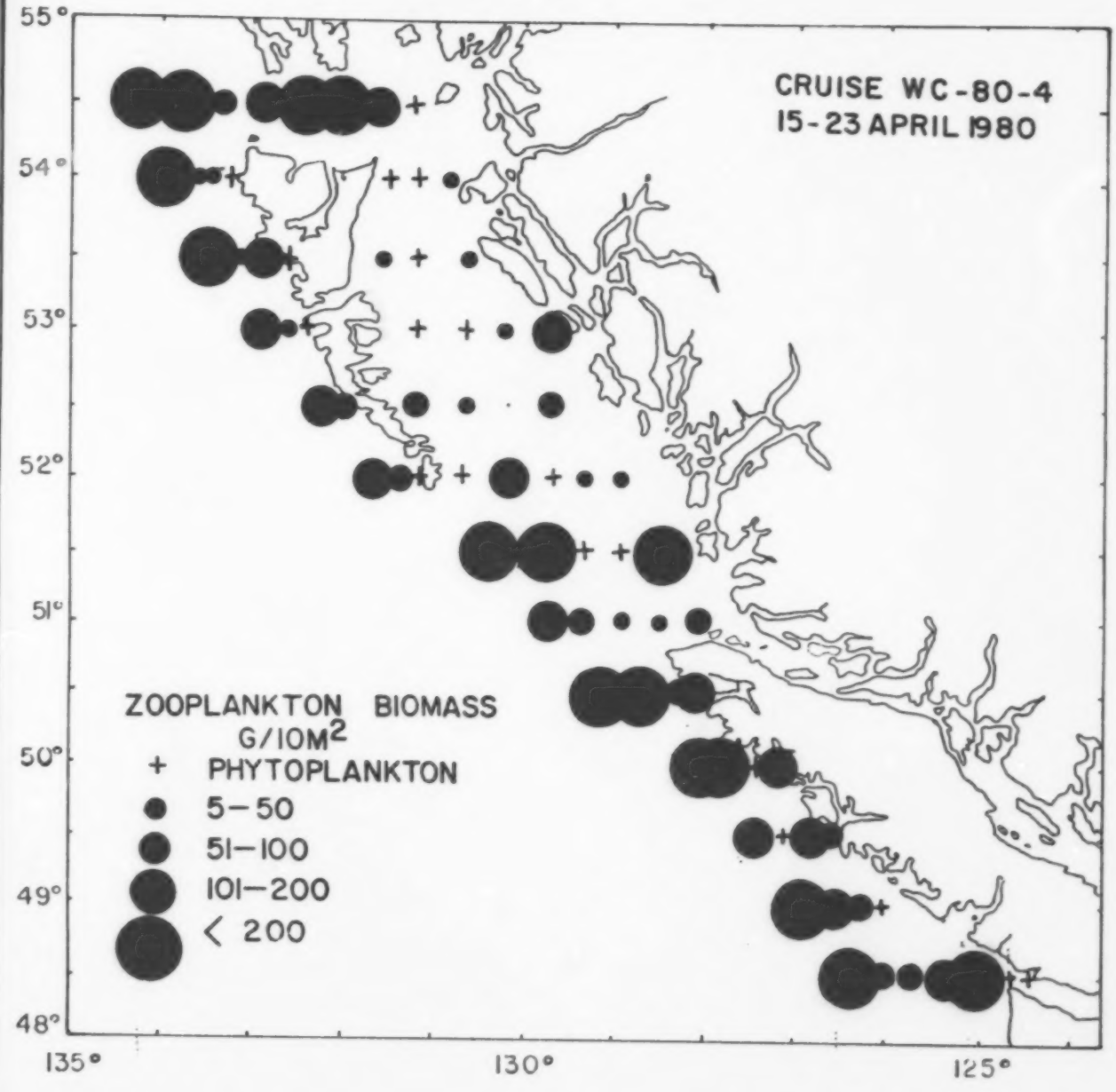

Figure 20. Distribution of zooplankton biomass - April.